Introduction

This manual provides information needed to operate and understand the vehicle and its components. More detailed information is contained in the *Owner's Warranty Information for North America* booklet, and in the vehicle's workshop and maintenance manuals.

Custom-built Freightliner vehicles are equipped with various chassis and cab components. Not all of the information contained in this manual applies to every vehicle. For details about components in your vehicle, refer to the chassis specification pages included in all new vehicles and to the vehicle specification decal, located inside the vehicle.

For your reference, keep this manual in the vehicle at all times.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Freightliner Trucks reserves the right to discontinue models and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, expressed or implied, and are subject to revisions and editions without notice.

Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should first attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

Event Data Recorder

This vehicle is equipped with one or more devices that record specific vehicle data. The type and amount of data recorded varies depending on how the vehicle is equipped (such as the brand of engine, if an air bag is installed, or if the vehicle features a collision avoidance system, etc.).

Customer Assistance Center

Having trouble finding service? Call the Customer Assistance Center at 1-800-385-4357 or 1-800-FTL-HELP. Call night or day, weekdays or weekends, for dealer referral, vehicle information, breakdown coordination, or Fleetpack assistance. Our people are knowledgeable, professional, and committed to following through to help you keep your truck moving.

Reporting Safety Defects

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Daimler Trucks North America LLC.

If the NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Daimler Trucks North America LLC.

To contact NHTSA, you may call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153); go to **www.safercar.gov**; or write to: Administrator, NHTSA, 1200 New Jersey Avenue, SE, Washington, DC 20590. You can also obtain other information about motor vehicle safety from **www.safercar.gov**.

Canadian customers who wish to report a safety-related defect to Transport Canada, Defect Investigations and Recalls, may telephone the toll-free hotline 1-800-333-0510, or contact Transport Canada by mail at: Transport Canada, ASFAD, Place de Ville Tower C, 330 Sparks Street, Ottawa, Ontario, Canada K1A 0N5.

For additional road safety information, please visit the Road Safety website at: **www.tc.gc.ca/roadsafety**.

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Foreword

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1

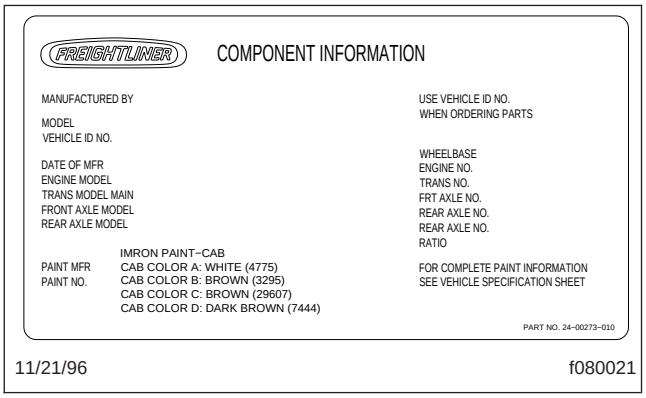
Vehicle Identification

Vehicle Specification Decal 1.1
Federal Motor Vehicle Safety Standard (FMVSS) Labels 1.1
Canadian Motor Vehicle Safety Standard (CMVSS) Labels 1.2
Tire and Rim Labels 1.2
EPA Emission Control Labels 1.2

Vehicle Identification

Vehicle Specification Decal

The vehicle specification decal lists the vehicle model, identification number, and major component models. It also recaps the major assemblies and installations shown on the chassis specification sheet. One copy of the specification decal is attached to the inside of the sliding storage/waste drawer. Another copy is inside the rear cover of the *Owner's Warranty Information for North America* booklet. An illustration of the decal is shown in **Fig. 1.1**.



11/21/96 f080021

Fig. 1.1, Vehicle Specification Decal, U.S.-Built Vehicle Shown

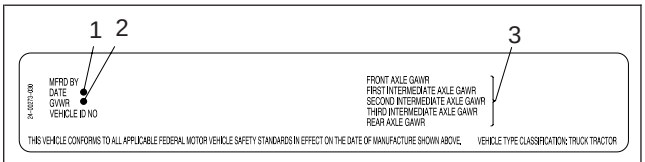
NOTE: Labels shown in this chapter are examples only. Actual specifications may vary from vehicle to vehicle.

Federal Motor Vehicle Safety Standard (FMVSS) Labels

NOTE: Due to the variety of FMVSS certification requirements, not all of the labels shown will apply to your vehicle.

Tractors with or without fifth wheels purchased in the U.S. are certified by means of a certification label (**Fig. 1.2**) and the tire and rim labels. These labels are attached to the left rear door post, as shown in **Fig. 1.3**.

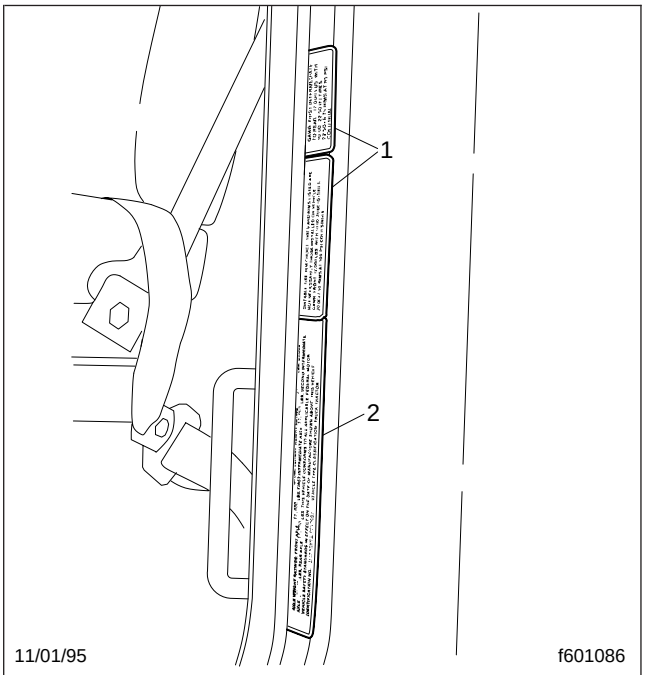
If purchased for service in the U.S., trucks built without a cargo body have a certification label (**Fig. 1.4**) attached to the left rear door post. See **Fig. 1.3**. In addition, after completion of the vehicle, a certification label similar to that shown in **Fig. 1.2** must be attached by the final-stage manufacturer. This label will be located on the left rear door post and certifies



11/21/96 f080053

1. Date of Manufacture: by month and year.
2. Gross Vehicle Weight Rating: developed by taking the sum of all the vehicle's gross axle ratings.
3. Gross Axle Weight Ratings: developed by considering each component in an axle system, including suspension, axle, wheels, and tires. The lowest component capacity is the value for the system.

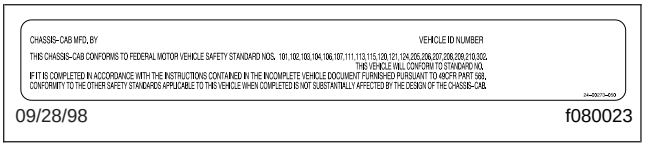
Fig. 1.2, Certification Label, U.S.



11/01/95 f601086

1. Tire and Rim Labels
2. Certification Label

Fig. 1.3, Labels Location


CHASSIS–CAB MFD. BY
VEHICLE ID NUMBER
THIS CHASSIS–CAB CONFORMS TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NOS. 101,102,103,104,106,107,111,113,115,120,121,124,205,206,207,208,209,210,302.
THIS VEHICLE WILL CONFORM TO STANDARD NO.
IF IT IS COMPLETED IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED IN THE INCOMPLETE VEHICLE DOCUMENT FURNISHED PURSUANT TO 49CFR PART 568.
CONFORMITY TO THE OTHER SAFETY STANDARDS APPLICABLE TO THIS VEHICLE WHEN COMPLETED IS NOT SUBSTANTIALLY AFFECTED BY THE DESIGN OF THE CHASSIS–CAB.

09/28/98 f080023

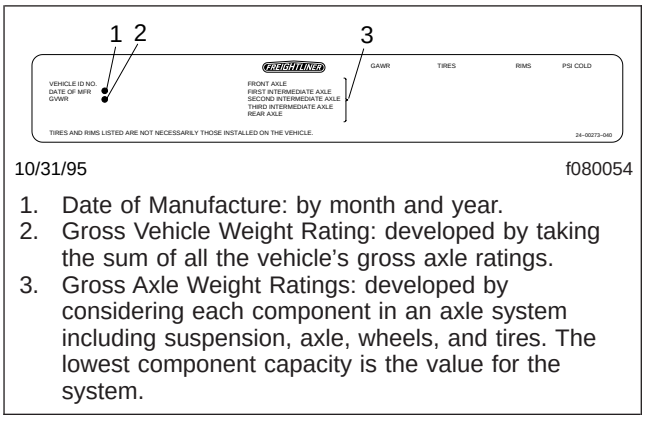
Fig. 1.4, Incomplete Vehicle Certification Label, U.S.

that the vehicle conforms to all applicable FMVSS regulations in effect on the date of completion.

Canadian Motor Vehicle Safety Standard (CMVSS) Labels

In Canada, tractors with fifth wheels are certified by means of a "Statement of Compliance" label and the Canadian National Safety Mark (**Fig. 1.5**), which are attached to the left rear door post. In addition, tire and rim labels (**Fig. 1.6**) are also attached to the left rear door post.

Fig. 1.5, Canadian National Safety Mark



1. Date of Manufacture: by month and year.
2. Gross Vehicle Weight Rating: developed by taking the sum of all the vehicle's gross axle ratings.
3. Gross Axle Weight Ratings: developed by considering each component in an axle system including suspension, axle, wheels, and tires. The lowest component capacity is the value for the system.

Fig. 1.6, Tire and Rim Label

If purchased for service in Canada, trucks built without a cargo body and tractors built without a fifth wheel are certified by a "Statement of Compliance" label, similar to **Fig. 1.2**. This label must be attached by the final-stage manufacturer after completion of the vehicle. The label is located on the left rear door post, and certifies that the vehicle conforms to all applicable CMVSS regulations in effect on the date of completion.

Tire and Rim Labels

Tire and rim labels certify suitable tire and rim combinations that can be installed on the vehicle, for the given gross axle weight rating. Tires and rims installed on the vehicle at the time of manufacture may have a higher load capacity than that certified by the tire and rim label. If the tires and rims currently on the vehicle have a lower load capacity than that shown on the tire and rim label, then the tires and rims determine the load limitations on each of the axles.

See **Fig. 1.6** for U.S. and Canadian tire and rim labels.

EPA Emission Control Labels

EPA Vehicle Noise Emission Control Label

A vehicle noise emission control label (**Fig. 1.7**) is attached either to the left side of the dashboard or to the top-right surface of the frontwall between the dash and the windshield.

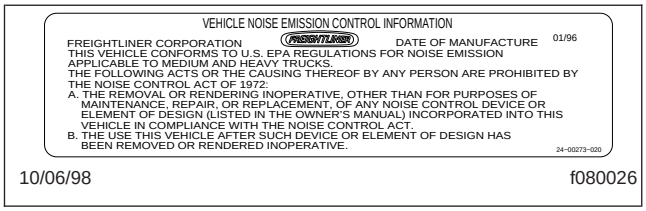

VEHICLE NOISE EMISSION CONTROL INFORMATION
FREIGHTLINER CORPORATION
FREIGHTLINER
DATE OF MANUFACTURE 01/96
THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS FOR NOISE EMISSION APPLICABLE TO MEDIUM AND HEAVY TRUCKS.
THE FOLLOWING ACTS OR THE CAUSING THEREOF BY ANY PERSON ARE PROHIBITED BY THE NOISE CONTROL ACT OF 1972:
A. THE REMOVAL OR RENDERING INOPERATIVE, OTHER THAN FOR PURPOSES OF MAINTENANCE, REPAIR, OR REPLACEMENT, OF ANY NOISE CONTROL DEVICE OR ELEMENT OF DESIGN (LISTED IN THE OWNER'S MANUAL) INCORPORATED INTO THIS VEHICLE IN COMPLIANCE WITH THE NOISE CONTROL ACT.
B. THE USE THIS VEHICLE AFTER SUCH DEVICE OR ELEMENT OF DESIGN HAS BEEN REMOVED OR RENDERED INOPERATIVE.
24-00273-030
10/06/98
f080026

Fig. 1.7, Vehicle Noise Emission Control Label

It is the owner's responsibility to maintain the vehicle so that it conforms to EPA regulations.

IMPORTANT: Certain Freightliner incomplete vehicles may be produced with incomplete noise control hardware. Such vehicles will not have a vehicle noise emission control information label. For such vehicles, it is the final-stage manufacturer's responsibility to complete the vehicle in conformity to U.S. EPA regulations (40 CFR Part 205) and label it for compliance.

EPA07 Exhaust Emissions Regulations

To meet EPA07 emissions regulations, engines manufactured after January 1, 2007, are equipped

with an emission aftertreatment device. A warning label on the driver's sunvisor explains important new warning indicators in the driver's message display that pertain to the aftertreatment system. See **Chapter 7** . Vehicles domiciled outside of the USA and Canada may not have aftertreatment equipment, depending upon local statutory emissions guidelines.

It is a violation of federal law to alter exhaust plumbing or aftertreatment in any way that would bring the engine out of compliance with certification requirements. (Ref: 42 U.S.C. S7522(a) (3).) It is the owner's responsibility to maintain the vehicle so that it conforms to EPA regulations.

2

Instruments and Controls Identification

Instrument and Control Panel 2.1
Controls 2.5
Instrumentation Control Unit, ICU4M 2.14
Instrumentation Control Unit, ICU3 . . . . . 2.24
Instrumentation Control Unit, ICU2M 2.26
Instrumentation Control Unit, ICU2L 2.38
Meritor™ WABCO® Antilock Braking System (ABS) 2.42
Collision Warning System (CWS), Eaton VORAD EVT–300 (Stand Alone) 2.42
Collision Warning System (CWS), Eaton VORAD EVT–300 (with ICU-Integrated display) 2.47
Lane Guidance™ System 2.52
Instruments 2.54
Exterior Switches 2.58

Instruments and Controls Identification

Instrument and Control Panel

Figure 2.1 and **Fig. 2.2** represent a portion of a typical Freightliner left-hand-drive (LH DR) dash. **Figure 2.3** and **Fig. 2.4** represent a portion of a typical Freightliner right-hand-drive (RH DR) dash. The left-hand-drive and right-hand-drive dashes are shown equipped with all of the standard and many of the optional instruments and accessories. Most standard and optional instrument gauges and switches can be mounted in either of these dashes.

The instrumentation control unit (ICU) houses most warning and indicator lights, most gauges, and a message display screen. Warning messages and diagnostic fault codes will appear in the message display screen. The dash light bars have warning and indicator lights that may be comprised of lettering, icons, or both. Until December 31, 2006, the warning and indicator lights are a mixture of ISO icons, and lettering. Since January 2007, ISO icons are used for all standard warning and indicator lights on the dash light bar. For more information, see the appropriate heading in this chapter, depending on the ICU installed in the vehicle.

See **Table 2.1** for descriptions of the standard warning and indicator lights used on the lightbars.

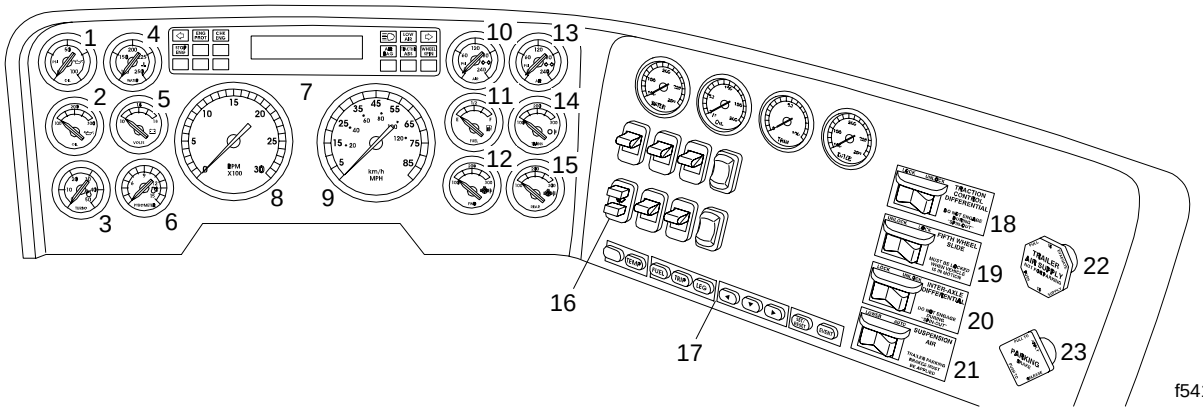
Warning and Indicator Lights		
	Check Engine Lamp (amber)	Indicates an undesirable engine condition is detected or recorded. The vehicle can still be driven. If the condition gets worse, the stop engine or engine protection light will illuminate.
	Stop Engine or Engine Protect Lamp (red)	Indicates a serious fault which requires the engine shut down immediately. The engine ECU will reduce the maximum engine torque and speed and, if the condition does not improve, will shut down the engine within 30 seconds of the light illuminating. The driver must safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, the engine can be restarted after turning the key to the OFF position for a few seconds.
	High Exhaust System Temperature (HEST) Lamp (amber)	Slow (10-second) flash, indicates a regeneration is in progress, and the driver is not controlling the engine idle speed. Solid illumination indicates a regeneration is in progress, with high exhaust temperatures at the outlet of the tail pipe, if the speed is below 5 mph (8 km/h). It does not signify the need for service; it only alerts the vehicle operator of high exhaust temperatures. See the engine operation manual for details.
	Diesel Particulate Filter (DPF) Lamp (amber)	Solid illumination indicates a regeneration is required. Change to a more challenging duty cycle, such as highway driving, to raise exhaust temperatures for at least 20 minutes, or perform a parked regeneration. See the engine operation manual for details. Blinking indicates that a parked regeneration is required immediately. An engine derate and shutdown will occur. See the engine operation manual for details on how to perform a stationary regeneration.
	Malfunction Indicator Lamp (MIL) (amber)	Indicates an engine emissions-related fault, including, but not limited to the aftertreatment system. See the engine operation manual for details.

Warning and Indicator Lights		
	Tractor ABS (amber)	Indicates a problem with the ABS is detected. Repair the tractor ABS immediately to ensure full antilock braking capability.
	Trailer ABS Lamp (amber)	Indicates a fault is detected with the trailer ABS.
	Left-Turn Signal (green)	Flashes on and off whenever the outside turn signal lights are flashing.
	Right-Turn Signal (green)	Flashes on and off whenever the outside turn signal lights are flashing.
	High-Beam Indicator (blue)	Indicates the headlights are on high beam.
	Low Air Pressure Warning (red)	Activates with a buzzer when air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).
	High Coolant Temperature Warning (red)	Activates with a buzzer when the coolant temperature goes above a maximum level specified by the engine manufacturer (see the engine manual).
	Low Engine Oil Pressure Warning (red)	Activates with a buzzer when engine oil pressure goes below a minimum level specified by the engine manufacturer (see the engine manual).
	Parking/Emergency Brake (BRAKE!) (red)	Indicates the parking brake is engaged, or hydraulic brake fluid pressure is low. A buzzer activates when the vehicle is moving over 2 mph (3 km/h) with the parking brake set.
	Fasten Seat Belt (red)	Illuminates for 15 seconds when the ignition key is turned to the ON position.
	Intake Heater (amber)	Indicates the intake air heater is active.
	Water in Fuel (amber)	Indicates that the fuel could contain water.
	Fuel Filter Restricted (amber)	Indicates that the fuel could contain water.
	Low Battery Voltage (red)	Indicates battery voltage is 11.9 volts or less.

Instruments and Controls Identification

Warning and Indicator Lights		
NO CHARGE	No Charge (amber)	Indicates an alternator charge output failure.

Table 2.1, Warning and Indicator Lights



NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Oil Pressure Gauge
2. Engine Oil Temperature Gauge
3. Turbocharger Boost Pressure Gauge
4. Coolant Temperature Gauge
5. Voltmeter
6. Pyrometer
7. Dash Message Center or Driver Message Center
8. Tachometer
9. Speedometer
10. Primary Air Pressure Gauge
11. Fuel Gauge
12. Forward Axle Oil Temperature Gauge
13. Secondary Air Pressure Gauge
14. Transmission Oil Temperature Gauge
15. Rear Axle Oil Temperature Gauge
16. Windshield Wiper/Washer Controls
17. 10-Key Keypad
18. Controlled Traction Differential Control Valve Switch
19. Fifth Wheel Air Slide Control Valve Switch
20. Interaxle Differential Lockout Control Switch
21. Air Suspension Dump Valve
22. Trailer Air Supply Valve
23. Parking Brake Control Valve

Fig. 2.1, Instrument and Control Panel Layout (upper LH DR dash shown)

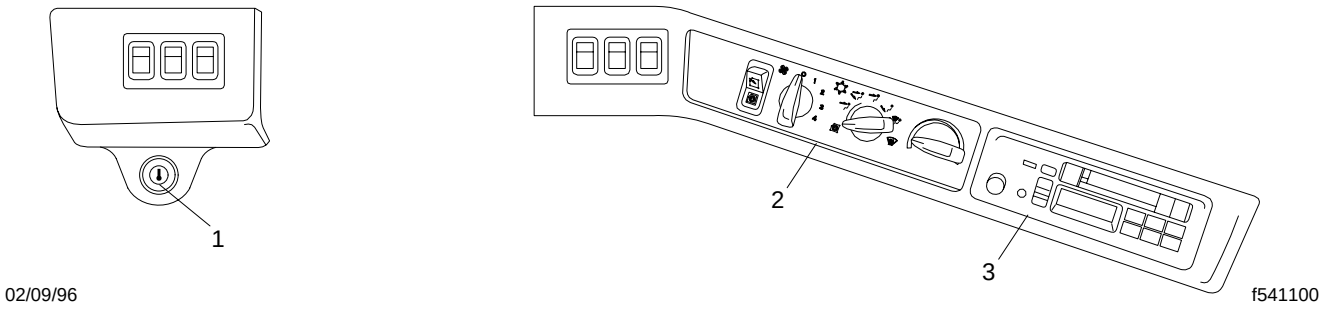
Engine Protection Warning and Shutdown

⚠ WARNING

When the red stop engine, or engine protection light illuminates, most engines are programmed to shut down automatically within 30 seconds. The driver must immediately move the vehicle to a safe location at the side of the road to prevent causing a hazardous situation that could cause bodily injury, property damage, or severe damage to the engine.

Certain engine conditions that are programmed for your engine will activate an engine protection shutdown sequence. The shutdown sequence can be activated by readings from the following sensors.

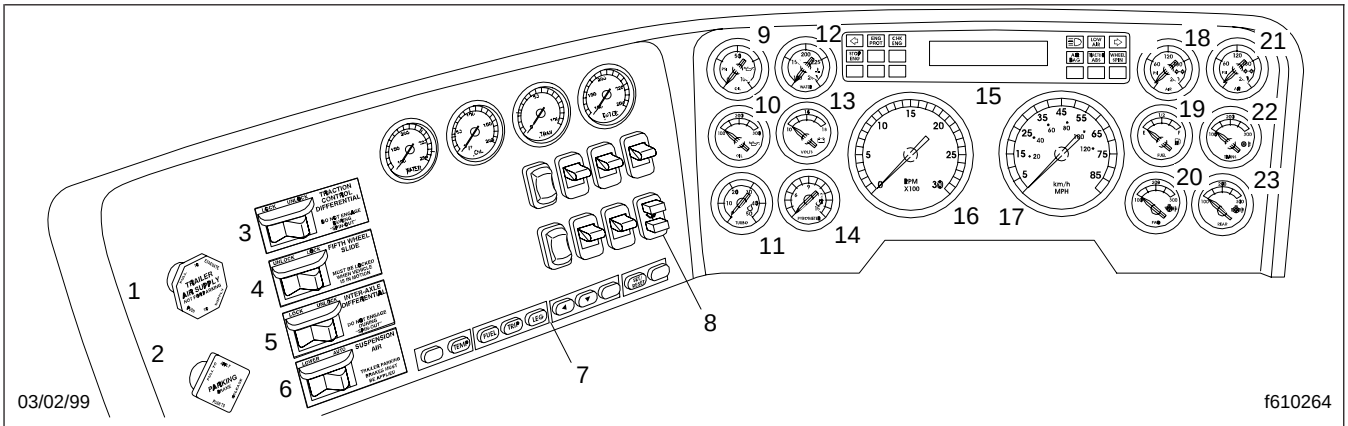
- engine coolant temperature
- engine coolant level
- engine oil pressure
- engine oil temperature
- engine intake air temperature
- diesel particulate filter for the exhaust aftertreatment system



NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Ignition Switch
2. Heater/Air Conditioner Controls
3. AM/FM Stereo Radio/Cassette-Player/Clock

Fig. 2.2, Instrument and Control Panel Layout (lower LH DR dash shown)



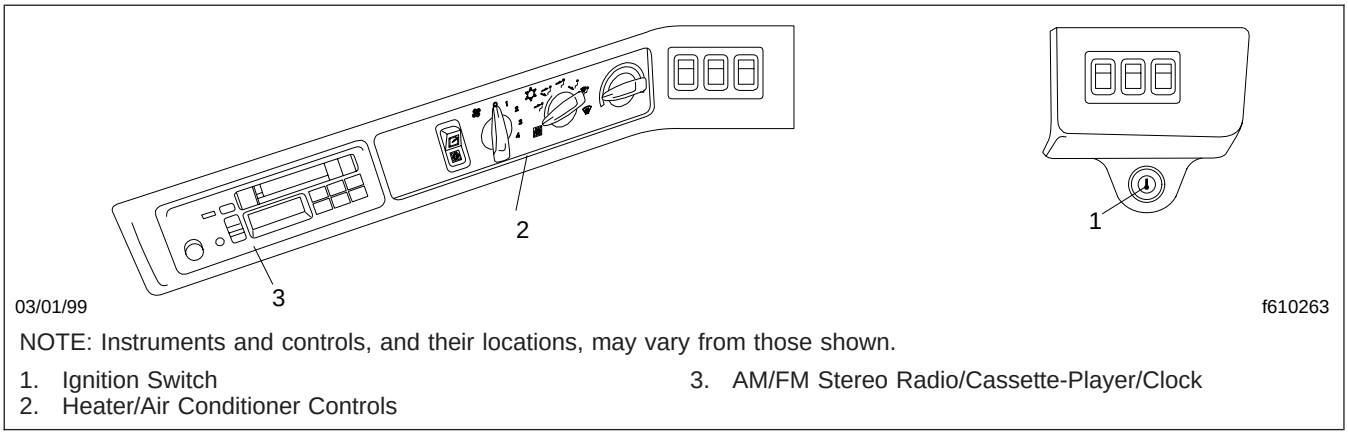
NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Trailer Air Supply Valve
2. Parking Brake Control Valve
3. Controlled Traction Differential Control Valve Switch
4. Fifth Wheel Air Slide Control Valve Switch
5. Interaxle Differential Lockout Control Switch
6. Air Suspension Dump Valve
7. 10-Key Keypad
8. Windshield Wiper/Washer Controls
9. Oil Pressure Gauge
10. Engine Oil Temperature Gauge
11. Turbocharger Boost Pressure Gauge
12. Coolant Temperature Gauge
13. Voltmeter
14. Pyrometer
15. Dash Message Center or Driver Message Center
16. Tachometer
17. Speedometer
18. Primary Air Pressure Gauge
19. Fuel Gauge
20. Forward Axle Oil Temperature Gauge
21. Secondary Air Pressure Gauge
22. Transmission Oil Temperature Gauge
23. Rear Axle Oil Temperature Gauge

Fig. 2.3, Instrument and Control Panel Layout (upper RH DR dash shown)

The engine protection shutdown sequence is as follows:

1. The red stop engine light, or engine protection light, comes on to indicate that the engine protection system has been activated.
2. The engine ECU begins to reduce the maximum engine torque and speed.
3. If the condition does not improve, the engine will shut down within 30 seconds.



NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Ignition Switch
2. Heater/Air Conditioner Controls
3. AM/FM Stereo Radio/Cassette-Player/Clock

Fig. 2.4, Instrument and Control Panel Layout (lower RH DR dash shown)

The driver must safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, the engine can be restarted after turning the key to the OFF position for a few seconds.

See **Chapter 7** in this manual, for the warning and shutdown modes associated with the exhaust aftertreatment system. There is a progressive series of warnings for the aftertreatment system.

Controls

Ignition Switch and Key

The ignition switch has four positions: ACCESSORY, OFF, ON, and START. The ignition key also locks and unlocks the cab doors, baggage door(s), and if equipped, the bunk door(s).

In the OFF position, the key slot is vertical; the key can be inserted and removed only in this position. The low-beam headlights, taillights, brake lights, road lights, dome lights, clearance lights, turn signals, hazard warning lights, utility and baggage lights, spotlights, horn, CB radio, power mirrors, cigarette lighter, clock, refrigerator, fuel heater, electric oil pan heater, and electric or diesel-fired engine-coolant preheaters can be operated in the OFF position (regardless of whether the key is inserted).

In the ACCESSORY position, the key is turned counterclockwise. The auxiliary (bunk) fan, windshield fan(s), radio or stereo system, mirror heat, ether start system, air dryer, backup lights, and all of the electrical systems that are operable in the OFF position are operable in the ACCESSORY position.

In the ON position, the key is turned clockwise. All electrical systems are operable. Low air- and oil-pressure warning lights (or messages) and buzzer operate until the engine is started and pressure is built up. The engine can be started and operated only when the ignition switch is ON.

Switching ON the ignition and releasing the parking brakes automatically activates the daytime running lights. The daytime running lights will operate until the parking brakes are applied; then, they will switch off. The vehicle must not be driven unless the daytime running lights are activated.

Idle Shutdown Timer

This feature is a 1- to100-minute idle shutdown system. Its purpose is to conserve fuel by eliminating excessive idling, and allowing a turbocharger cool-down period. To activate the shutdown, the transmission must be in neutral with the vehicle parking brakes set and the engine in idle or fast-idle mode.

Mirror Heat Switch

One or both outside door mirrors can be heated to keep them defrosted. Whenever the mirror heat switch is on, an amber indicator light illuminates in the switch.

Power Mirrors

Both outside mirrors can be equipped with an electrical remote control. Operate the driver door-mounted switch to adjust the mirror.

Exhaust Aftertreatment Regen Switch

A parked regen of the aftertreatment system can be initiated with the regen switch. Refer to **Chapter 7** for instructions on how to perform a parked regen.

An optional regen requeSt/inhibit switch provides additional control over the aftertreatment regeneration process. When activated, the inhibit switch will stop a regeneration cycle in progress, and prevent the start of a regeneration cycle until the switch is no longer active. See **Fig. 2.5**.

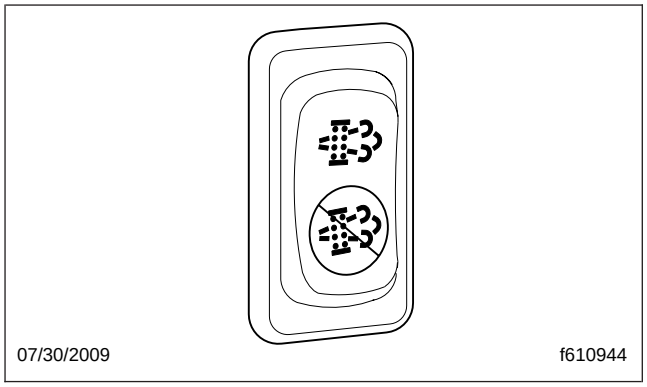


Fig. 2.5, Regen Request/Inhibit Switch

Low Voltage Disconnect

The Sure Power Low Voltage Disconnect (LVD) system monitors battery power when accessories are being used when the engine is shut down. The system automatically turns off cab and sleeper accessories when voltage drops to 12.3 volts to ensure that there is enough battery power to start the vehicle. An alarm sounds for one minute before accessories are turned off. If no action is taken within that minute, the LVD module will shut off power to predetermined cab and sleeper circuits and illuminate an LED indicator on the LVD module located inside the right-hand door frame behind the seat. These circuits will remain off until the LVD measures 13.0 volts applied to the system, which can be done by starting the engine. After the engine is started, the system will reset.

All vehicles equipped with LVD should have a sticker on the dash indicating the presence of the system. Another sticker is located inside the right-hand door frame behind the seat, along with the LVD module.

Battery Isolator System

A battery isolator system has two or three regular batteries to turn the starter motor, and one or two gel cell batteries to provide power for cab and sleeper accessories when the engine is off. The system uses an isolator relay, which is normally open. The relay isolates the engine-starting batteries while the engine is not running, so the engine can still be started even if the gel cell has been used to the point of complete discharge.

The isolator relay is closed only while the engine is running. With the engine running, all four batteries are connected in parallel allowing the alternator to charge them all in addition to supplying power for all vehicle loads.

When the engine is not running, the gel cell provides all of the vehicle's electrical needs except for turning the starter motor.

The gel cell is longer-lived and cheaper to use than a standard wet cell, but it can take a charge only within an extremely narrow range—13.8 to 14.1 volts.

At 14 volts, a gel cell has a very high charge acceptance rate. Because a truck charging system operates at approximately 14 volts, under normal conditions a gel cell will never need to be recharged with an external charger.

NOTICE

Do not attempt to charge a gel cell with a standard battery charger. All standard battery chargers supply at least 16 volts to the battery. This will damage the gel cell.

However, the single gel cell has limited current-supply capability and will drain down faster than a standard multiple-battery installation that has no battery isolator system. Avoid ultra-deep discharging. Repeated ultra-deep discharging of a gel cell will significantly reduce its life.

To protect against ultra-deep discharging, a low voltage warning alarm and indicator light activate when the battery voltage falls to 12.0 volts or less. To silence the alarm, turn off all cab electrical loads or start the engine.

IMPORTANT: To recharge a gel cell, see an authorized Freightliner dealer or the instructions in **Group 54** of the *Century Class Trucks Workshop Manual*.

Road Light Switch

The road light switch operates the road lights mounted on the bottom edge of the front bumper or recessed in the front bumper.

For vehicles built to operate in the United States, the low-beam headlights must be turned on before the road lights can be turned on. The road lights will not go on if the high-beam headlights are already on, and switching from low beams to high beams will switch off the road lights.

For vehicles built to operate in Canada, the marker lights must be on before the road lights can be turned on.

Utility Light Switch

Utility lights can be swivel-mounted on top of the cab, mounted on the intake/exhaust support, or flush-mounted in the back of the cab or sleeper box. They are operated by the utility light switch, which when turned on also illuminates a red indicator light in the switch (if equipped).

Panel Lamp Control Switch

The circuit to the panel lamps is activated by the headlight switch. When the headlights are on, the panel lamp switch controls the intensity of the instrument panel lamps. Slide the switch up to brighten them and down to dim them.

Headlight Switch and Daytime Running Lights

A three-position headlight switch is used to operate the exterior lights. When the switch is up, the headlights and all other vehicle lights are on. All vehicle lighting is off when the switch is in the middle position. When down, the switch activates only the clearance, instrument panel, marker lights, and the taillights. The switch for the headlight high beams is built into the turn signal lever. When the headlights are on high beam, a blue light in the warning and indicator light module goes on. The ignition switch must be on for the high beams to operate.

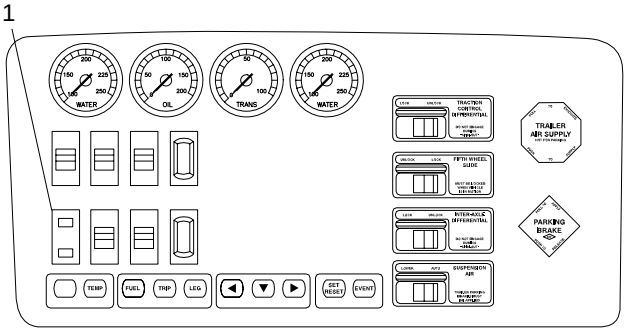
Switching on the ignition and releasing the parking brakes automatically activates the daytime running lights. The daytime running lights will operate until the parking brakes are applied; then, they will switch off. The vehicle must not be driven unless the daytime running lights are activated.

Interrupt Switch

A spring-loaded interrupt switch temporarily deactivates the marker lights and taillights. With the vehicle lights on, raise and release the interrupt switch to briefly turn off the marker lights and taillights. To alert the driver that the switch is functioning, the dash lights will flash with the marker lights when the switch is actuated.

Windshield Wiper/Washer Controls

The wipers are operated by a double-paddle switch mounted on the auxiliary instrument panel. See **Fig. 2.6**. The top paddle, when pushed in, turns the wipers on (if they are off) or off (if they are on). When it is pushed up, the top paddle switches the wipers to high speed; when it is pushed down, it switches them to low speed.



11/15/95 f541127

1. Windshield Wiper/Washer Switch

Fig. 2.6, Instrument Panel

The bottom paddle, when pushed in, turns the washers on. When pressed for less than 1/2-second, the wipers will perform a single, low speed dry wipe (mist function). When pressed for more than 1/2-second, the wash cycle begins and continues for three cycles or until the paddle is released. When the bottom paddle is pushed up, the wipers operate in fast delay. When the bottom paddle is pushed down, the wipers operate in slow delay. With the wipers in

delay mode (fast or slow), push the bottom paddle up to shorten the delay period, or push the paddle down to lengthen it.

NOTICE

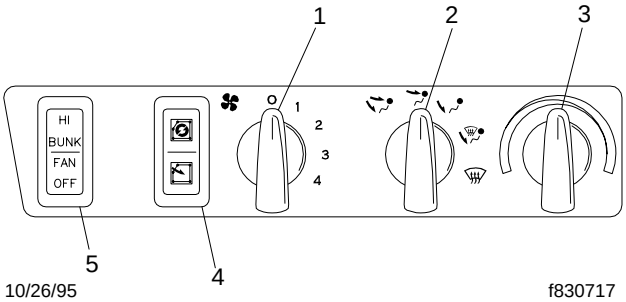
Do not move the wiper arms manually. Wiper motor damage will occur if the arms are moved.

Left and Right Windshield-Fan Switches

Ceiling-mounted defogger fans are operated by "Low/Off/High" toggle switches located in the base of the fan.

Heater/Air-Conditioner Controls

Heater/air conditioner controls consist of a four-speed fan switch, an air selection switch, a temperature control switch, and a fresh air/recirculation switch. See **Fig. 2.7**. See **Chapter 4** for detailed operating instructions of the heater/air conditioner.



1. Fan Switch
2. Air Selection Switch
3. Temperature Control Switch
4. Fresh Air/Recirculation Switch
5. Auxiliary (sleeper bunk) Switch

Fig. 2.7, Heater/Air Conditioner Controls

Interaxle Differential Lockout Control Valve Switch

Differential lockout, standard on all dual-drive vehicles, is driver-actuated by means of a "Lock/Unlock" control valve switch (**Fig. 2.8**) mounted on the control panel. A red indicator light comes on whenever the interaxle differential is locked out (switch is in the lock position; no differential action between the drive axles). A guard around the switch minimizes accidental activation.

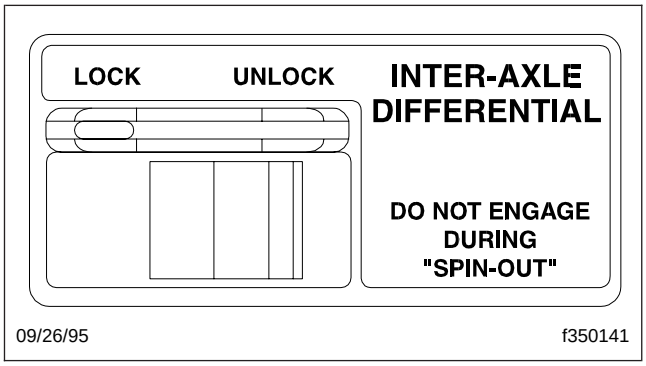


Fig. 2.8, Interaxle Differential Lockout Switch

Fifth Wheel Air Slide Control Valve Switch

The fifth wheel air slide valve permits repositioning of the sliding fifth wheel from inside the cab. Moving the air slide control valve switch (**Fig. 2.9**) to the lock position deactivates the control valve and locks the fifth wheel to the baseplate. Moving the switch to the unlock position activates the control valve and unlocks the fifth wheel slide mechanism, allowing changes to the total length of the tractor-trailer and changes to axle loads, to comply with varying state or provincial laws. A red indicator light, if so equipped, is illuminated whenever the fifth wheel slide is unlocked. A guard is positioned around the switch to minimize accidental activation.

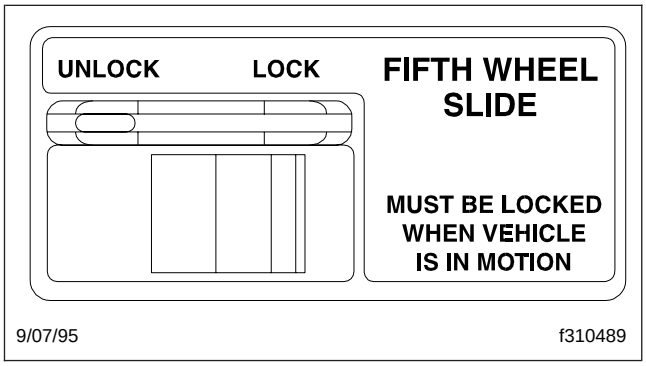


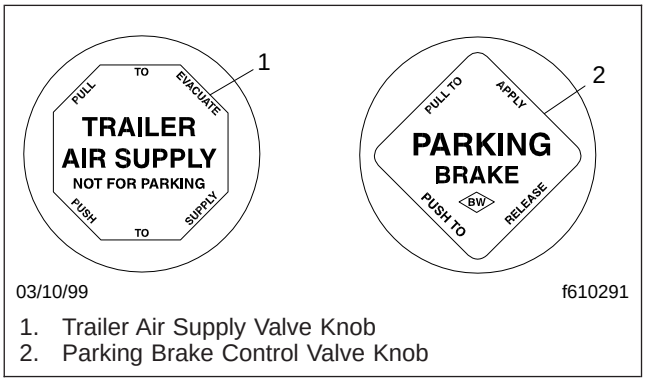
Fig. 2.9, Fifth Wheel Air Slide Switch

NOTICE

Do not activate the fifth wheel slide control valve while the vehicle is in motion. To do so could cause damage to the fifth wheel member, the kingpin, the cab or trailer, and ultimately to the drivetrain.

Parking Brake Control Valve

The yellow diamond-shaped knob (**Fig. 2.10**) operates the parking brake valve. Pulling the knob applies both the tractor and the trailer spring parking brakes. Pushing in the knob releases the tractor spring parking brakes. Before the spring parking brakes can be released, the air pressure in either air brake system must be at least 65 psi (447 kPa).



1. Trailer Air Supply Valve Knob
2. Parking Brake Control Valve Knob

Fig. 2.10, Brake Valve Knobs

See **Chapter 6** under the heading "Brake System" for instructions regarding use of the parking brake valve.

Trailer Air Supply Valve

The red octagonal-shaped knob (**Fig. 2.10**) operates the trailer air supply valve. After the vehicle and its air hoses are connected to a trailer and the pressure in the air system is at least 65 psi (447 kPa), the trailer air supply valve knob must be pushed in (and should stay in) to charge the trailer air supply system and release the trailer spring parking brakes. Before disconnecting a trailer or when operating a vehicle without a trailer, the trailer air supply valve knob must be pulled out.

See **Chapter 6** under the heading "Brake System" for instructions regarding use of the trailer air supply valve.

Controlled Traction Differential Control Valve Switch

A controlled traction differential feature is included on some rear axles. A control valve switch (**Fig. 2.11**) engages and disengages the controlled traction feature. A guard is positioned around the switch to minimize accidental activation.

See **Chapter 9** for complete operating instructions.

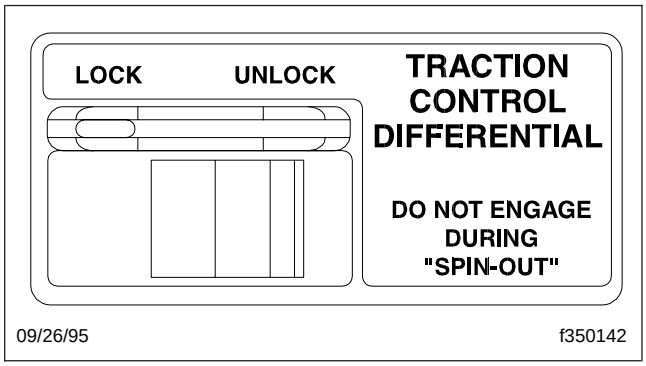


Fig. 2.11, Controlled Traction Differential Switch

Air Suspension Dump Valve

The air suspension dump valve allows the air in the vehicle air suspension to be quickly exhausted, lowering the rear of the vehicle. This makes it easier to connect to or disconnect from a trailer. A control valve switch (**Fig. 2.12**) exhausts and fills the air suspension. To exhaust air from the suspension, move the switch to LOWER. A guard is positioned around the switch to minimize accidental activation.

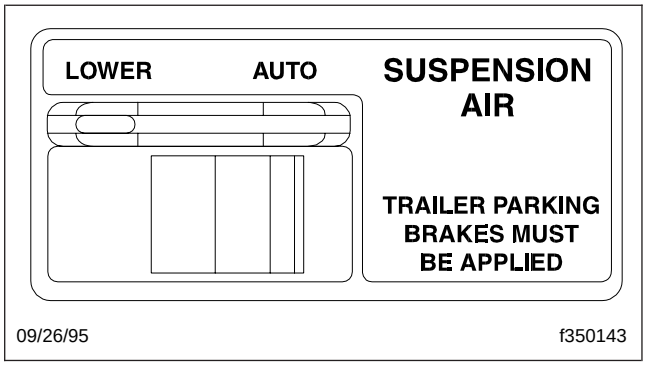


Fig. 2.12, Air Suspension Dump Valve

NOTICE

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from reinflating.

NOTICE

Never exhaust air from the suspension while driving. If the air is exhausted, the suspension will not absorb road shocks and could be damaged.

Lane Guidance™ System Rocker Switch

The lane departure warning system is controlled by a dash-mounted rocker switch that toggles the system on and off. Additional information is detailed later in this chapter.

Automatic Engine Idler/Timer

A Henke automatic engine idler/timer allows the driver to select the idle time required for engine shutdown. The driver can turn off the ignition, remove the ignition key, lock the vehicle, and leave it with the engine idling; the automatic timer will shut the engine off at the end of the selected time.

Cigarette Lighter

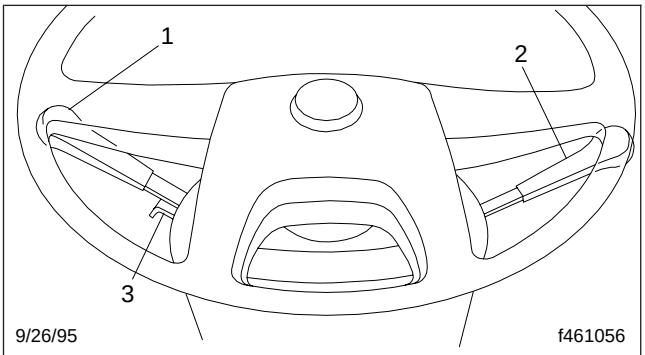
Push in the lighter to heat the element. The lighter will stay in, then will automatically pop out when the element is hot.

CB Radio Connections

An antenna connection and positive (+) and negative (–) power connections are provided for a CB radio.

Turn Signal Lever

The turn signal lever (**Fig. 2.13**) is mounted on the steering column. Pushing the lever counterclockwise turns on the left-turn signal lights; pushing it clockwise turns on the right-turn signal lights. When one of the signal lights is on, a green indicator light flashes at the far left or far right of the warning and indicator light panel. To cancel the signal, return the lever to the neutral position.



1. Turn Signal Lever
2. Trailer Brake Hand Control Valve Lever
3. Hazard Warning Light Switch Tab

Fig. 2.13, Steering Column-Mounted Controls

Hazard Warning Light Switch Tab

The hazard warning light switch tab (**Fig. 2.13**) is located below the lever on the turn signal switch. Hazard warning lights are operated by pulling the tab out. When the hazard warning light switch tab is pulled out, all of the turn signal lights and both of the indicator lights on the control panel will flash. To cancel the warning lights, move the turn signal lever up or down.

Headlight Dimmer

Pull the turn signal lever toward the steering wheel to change from low-beam to high-beam headlights, or from high beam back to low beam.

When the headlights are on high beam, a blue light on the indicator light panel comes on. For vehicles built to operate in the United States, switching from low beams to high beams will switch off the road lights.

NOTE: The ignition switch must be on for the high beams to work.

Trailer Brake Hand Control Valve Lever

The trailer brake hand control valve lever (**Fig. 2.13**) is used for applying the trailer brakes without applying the truck or tractor brakes, and is mounted on the

steering column. See **Chapter 6** under the heading "Brake System" for operating instructions.

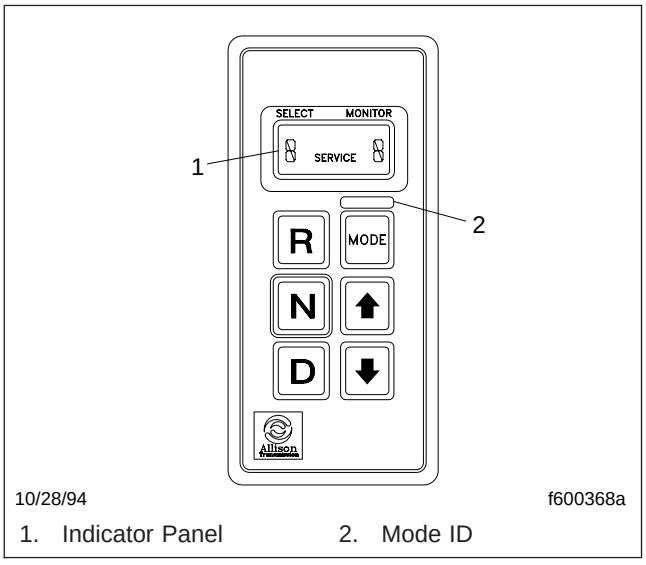
Transmission Controls

If so equipped, the transmission range control valve and splitter valve are attached to the gearshift knob. Transmission shift pattern labels are located inside the cab.

See **Chapter 8** for complete transmission operating instructions.

Allison Automatic Transmission Controls

Allison HD-series automatic transmission models are controlled by an electronic control unit (ECU). The ECU processes information from sensors, pressure switches, and the shift selector (**Fig. 2.14**) to automatically control the transmission according to programmed specifications.



1. Indicator Panel
2. Mode ID

Fig. 2.14, Allison Push Button Shift Selector

Vehicles with these transmissions have a red do-not-shift light in the lens and bezel assembly. Also, there is a service light in the indicator panel on the shift selector. With the ignition switch on, both lights come on for a few seconds; then, if there is no problem with the transmission system, the lights will go out. Whenever there is a problem with the transmission system, the lights will come on and stay on as long as the problem exists.

If "service" is displayed in the indicator panel, some features may not work but the vehicle can still be driven. If the do-not-shift light comes on while driving (accompanied by eight short beeps from the shift selector), operating limits will be placed on the transmission, such as restricting upshifts and downshifts. However, the vehicle can still be driven to reach service assistance. In either situation, have the problem repaired as soon as possible. See the Allison Transmission Service Manual for troubleshooting procedures.

See **Chapter 8** for complete transmission operating instructions.

Suspension Seat Adjustment Controls

All adjustment controls for a suspension seat are located on the seat base. See **Chapter 5** for complete instructions.

Dome Light Switches

Diffuse dome lights are installed on all cabs. See **Fig. 2.15** and **Fig. 2.16**. The dome lights are located either on the overhead console, or on the cab roof (if no overhead console is installed). Both dome lights turn on when either the driver's or passenger's door is opened. The dome lights can also be turned on by pressing in on the light lens.

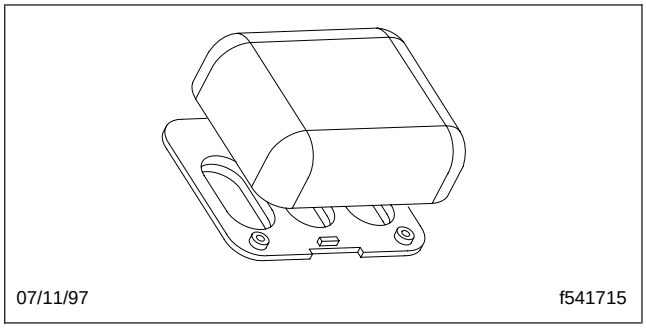


Fig. 2.15, Dome/Tray, Red Map, and Clear Reading Lights

Red Map Light Switches

Red map lights are available on all cabs. See **Fig. 2.15** and **Fig. 2.16**. They are located next to the dome lights in the same fixture. Like the dome lights, the map lights can be turned on by pressing in on the light lens.

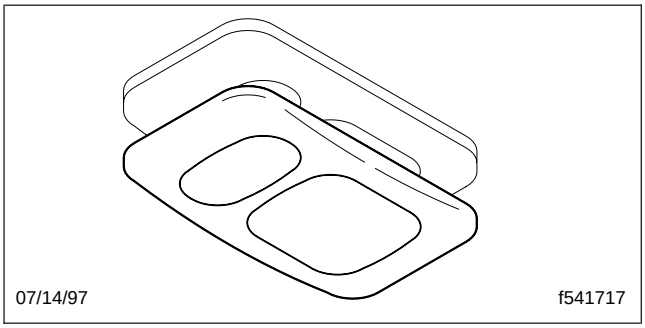


Fig. 2.16, Dome Light with Red Map Light

Clear Reading Light Switches—SleeperCabs Only

Clear reading lights are available on sleepers only. See **Fig. 2.15**. They are located next to the dome lights in the same fixture. Like the dome lights, the reading lights can be turned on by pressing in on the light lens.

Courtesy Light Switch

Courtesy lights are available on all cabs. They illuminate the footwell area on both sides of the cab. The driver's courtesy light (**Fig. 2.17**) is attached to the steering column and the passenger's footwell light (**Fig. 2.18**) is located on the lower right dash panel. To turn on the courtesy lights, press the rocker switch on the dash. When the lights are on, the switch is illuminated by a light inside it.

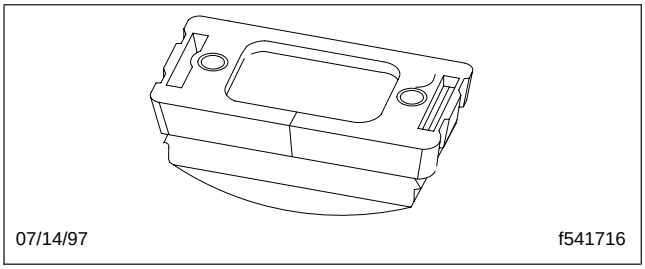


Fig. 2.17, Driver's Floor Courtesy Light

Rear-Wall Fluorescent Light Switches

A rear-wall fluorescent light (**Fig. 2.19**) is available on all raised roof cabs. It is located on the rear wall where the wall meets the roof. To turn on the rear-wall fluorescent light, press the rocker switch on either the lower or upper bunk control panels (**Fig. 2.20**).

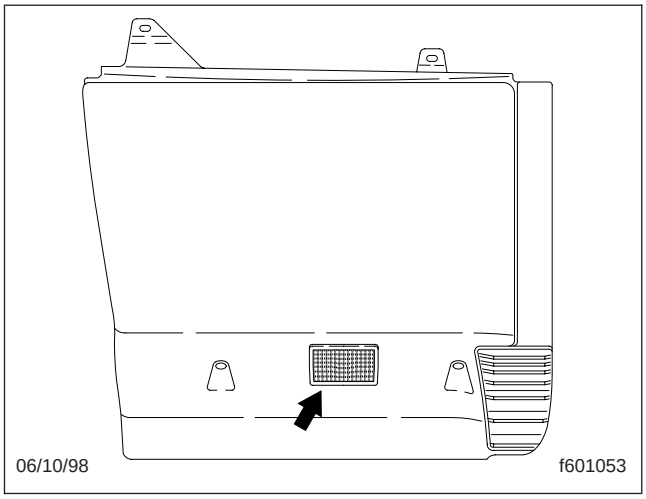
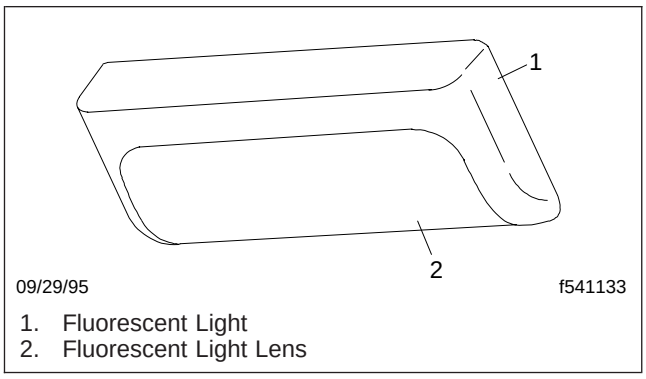


Fig. 2.18, Passenger's Footwell Courtesy Light



1. Fluorescent Light
2. Fluorescent Light Lens

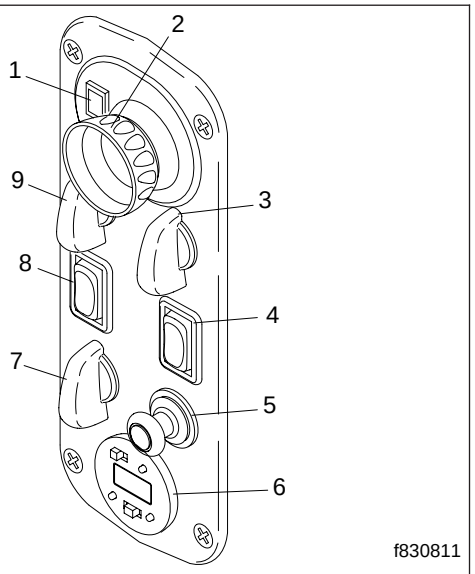
Fig. 2.19, Mid-Roof Fluorescent

Mid-Roof Fluorescent Light Switches, SleeperCabs Only

A mid-roof fluorescent light (curtain bow light) is standard on sleepers only. It is located on the ceiling in the middle of the cab where the curtain is drawn to separate the bunk area from the rest of the cab. See **Fig. 2.19**. To turn on the mid-roof fluorescent light, press the rocker switch on the dash, or on either the lower or upper bunk control panels (**Fig. 2.20**).

Bunk Reading Light Switches—SleeperCabs Only

Bunk reading lights are high-intensity reading lights for use when reading in the bunk. They are located on the bunk control panel for each bunk. To turn on the bunk reading lights, press the rocker switch on



1. Reading Light Switch
2. Reading Light
3. A.T.C. Control Knob
4. Dome Light Switch
5. Cigarette Lighter
6. Clock
7. Volume Control Knob
8. Dome Light Switch
9. Fan Control Knob

Fig. 2.20, Bunk Reading Light and Control Panel

the bunk control panel that holds the light. See **Fig. 2.20**.

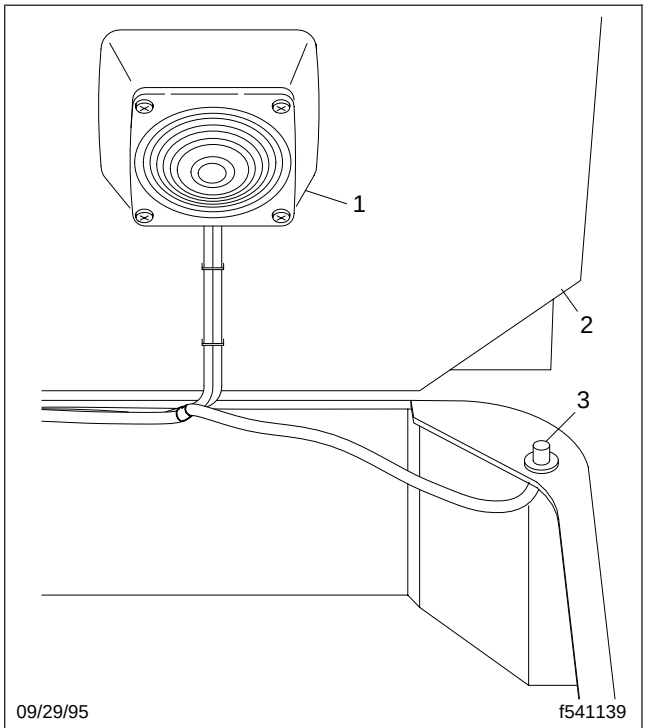
Baggage Compartment Light Switches, SleeperCabs Only

Baggage compartment lights are installed in all SleeperCabs. One light is located on each side of underside of the lower bunk, and illuminates the baggage compartment. Both lights turn on when either baggage compartment door is opened. The lights also come on when the lower bunk is raised. See **Fig. 2.21**.

Tilt Steering Wheel

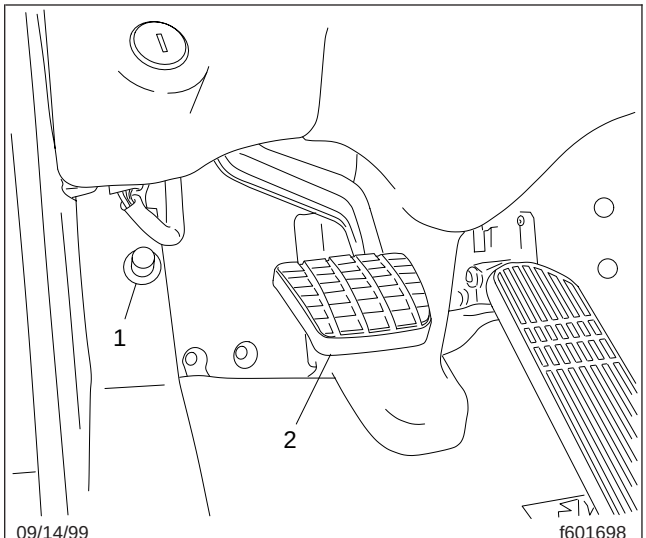
The tilt steering wheel control button (**Fig. 2.22**) is located to the left of the brake (automatic transmissions) or clutch (manual transmissions) pedal.

After adjusting the seat to the desired ride position, unlock the steering column by pushing and holding the control button all the way down. Tilt the steering column to the desired position, then release the control button to lock the steering column in place.



1. Under-Bunk Light
2. Bunk
3. Switch

Fig. 2.21, Baggage Compartment Light



1. Control Button
2. Clutch Pedal

Fig. 2.22, Tilt Steering Wheel Control Button

⚠ WARNING

Make sure that the steering column is locked before driving the vehicle. Never tilt the column while driving the vehicle. Doing so could cause loss of vehicle control, personal injury, and property damage.

Instrumentation Control Unit, ICU4M

General Information

The ICU4M is used on pre-EPA07 engines, and the ICU4M-2 is used on vehicles with engines that are EPA07 compliant. They can be differentiated by the exhaust icons in the middle row of the dash message center on the ICU4M-2. See **Fig. 2.23** and **Fig. 2.24**.

The ICU4M/ICU4M-2 instrument cluster is an individual-gauge cluster, with an intelligent lightbar and integrated warning and indicator lights. See **Fig. 2.25**. Some main features of the ICU4M/ICU4M-2 are:

- gauges sweep 270 degrees and have pointers lit by an LED (light-emitting diode)
- service intervals are programmable from the keypad
- a warning chime and alert message display warns the driver if the door is opened without first setting the parking brake
- if low oil pressure or high coolant temperature is detected, a red warning light at the bottom of the gauge illuminates, a warning buzzer sounds, and a flashing alert message appears on the display, along with a text message giving additional information

The dash message center is the heart of the ICU4M/ICU4M-2. It has three parts:

- a set of 24 warning and indicator lights;
- a 10-key keypad on the auxiliary instrument panel;
- a message display screen in the center.

The message display screen is a two-line by twenty-character liquid crystal display (LCD).

Gauges

There can be up to 14 removable gauges on the driver's instrument panel. The ICU4M/ICU4M-2 can also drive gauges located on the auxiliary instrument panel. Gauges cannot be removed from the front of the panel.

The standard gauges are:

- speedometer
- engine coolant temperature
- engine oil pressure
- battery voltmeter
- fuel level

Other available gauges include:

- tachometer
- engine oil temperature
- transmission fluid temperature
- rear axle temperature; on vehicles with tandem axles, forward-rear, and rear-rear
- ammeter
- system air pressure; primary, secondary, application, and suspension
- pyrometer
- turbo boost air pressure

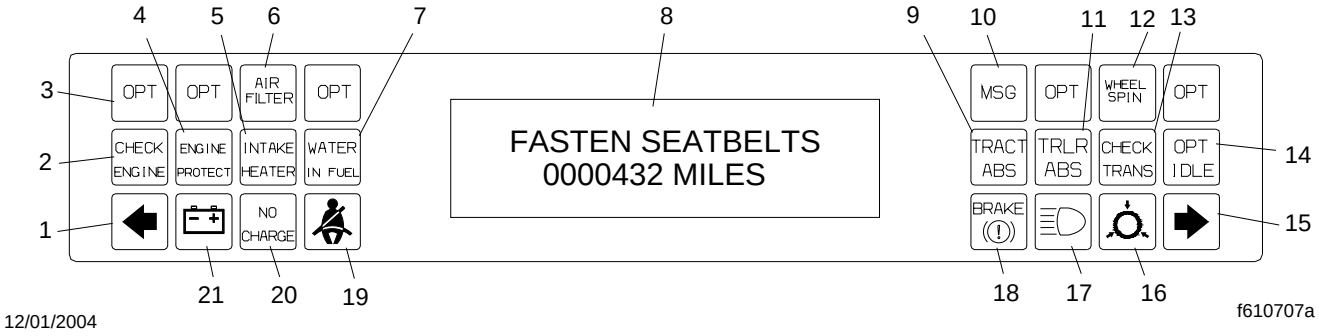
Some gauges have a red warning light integrated into the gauge. These are listed below, with an indication of how the warning light is activated:

- engine coolant temperature (high)
- engine oil pressure (low)
- fuel level (low)
- transmission fluid temperature (high)

Keypad

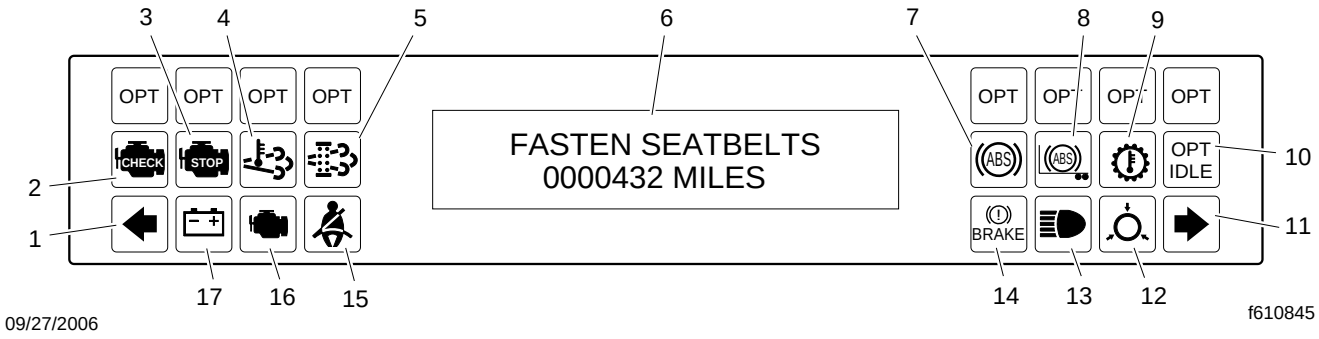
The ICU4M/ICU4M-2 is controlled by a keypad located on the auxiliary dash panel. See **Fig. 2.26**. This keypad, which has 10 keys, can be used to do the following tasks:

- Call up information onto direct access screens while the vehicle is moving, using the dedicated keys (TEMP, FUEL, TRIP, and LEG).



1. Left Turn Signal
2. Check Engine Indicator
3. Optional Indicator
4. Engine Protection Warning
5. Intake Heater Indicator
6. Air Filter Indicator
7. Water in Fuel Indicator
8. Message Display Screen
9. Tractor ABS Indicator
10. Message Indicator
11. Trailer ABS Indicator
12. Wheel Spin Indicator
13. Check Transmission Indicator
14. Optimized Idle Indicator
15. Right Turn Signal
16. Low Air System Pressure Warning
17. High Beam Indicator
18. Parking/Emergency Brake Warning
19. Fasten Seat Belt Warning
20. No Charge Indicator (alternator)
21. Low Vehicle Battery Voltage

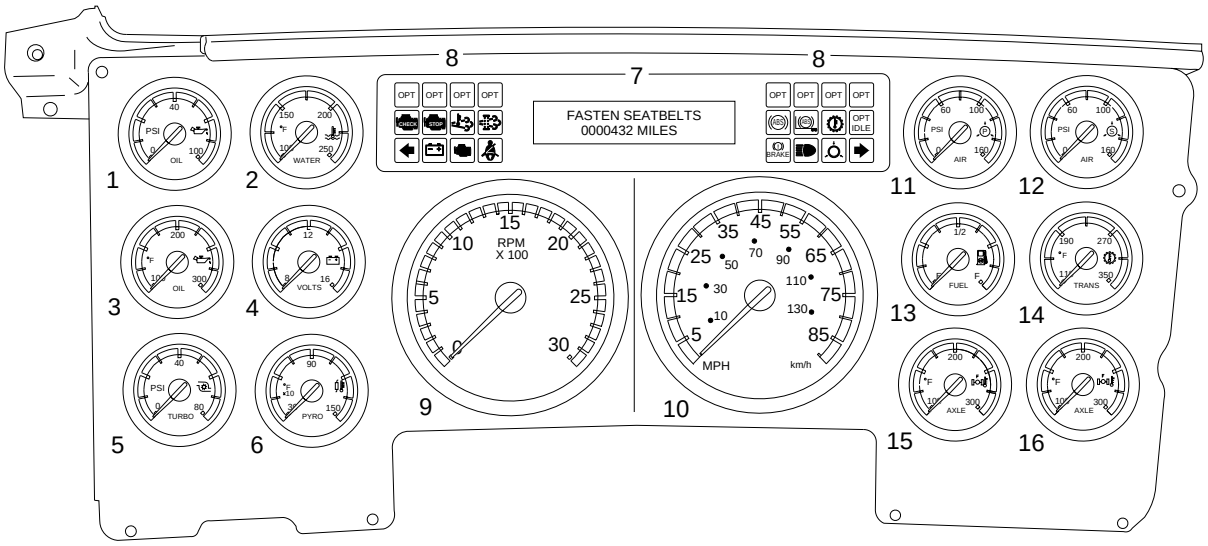
Fig. 2.23, ICU4M Dash Message Center (typical) Pre-2007



1. Left Turn Signal
2. Check Engine Indicator
3. Stop Engine Warning
4. High Exhaust System Temperature (HEST) Warning
5. Diesel Particulate Filter (DPF) Status Lamp
6. Message Display Screen
7. Tractor ABS Indicator
8. Trailer ABS Indicator
9. Check Transmission Indicator
10. Optimized Idle Indicator
11. Right Turn Signal
12. Low Air System Pressure Warning
13. High Beam Indicator
14. Parking/Emergency Brake Warning
15. Fasten Seat Belt Warning
16. Malfunction Indicater Lamp (MIL)
17. Low Vehicle Battery Voltage

Fig. 2.24, ICU4M-2 Dash Message Center (typical) EPA07 Compliant

- Move from screen to screen while the vehicle is stationary using the general keys (left, right, and down arrow keys).
- Program on-screen service intervals, screen brightness, language, units of measurement, and other display functions, using the set function of the SET/RESET key.



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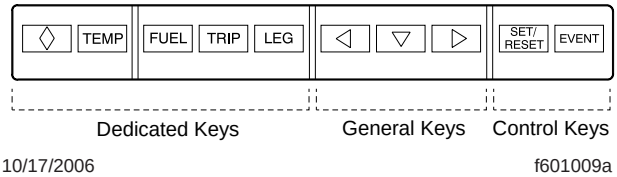
1. Engine Oil Pressure Gauge
2. Engine Coolant Temperature Gauge
3. Engine Oil Temperature Gauge
4. Battery Voltage Gauge
5. Turbo Boost Air Pressure Gauge
6. Pyrometer
7. Dash Message Center
8. Warning and Indicator Lights
9. Tachometer
10. Speedometer
11. Primary Air Pressure Gauge
12. Secondary Air Pressure Gauge
13. Fuel Level Gauge
14. Transmission Fluid Temperature Gauge
15. Tandem Rear Axle Temperature Gauge, Forward
16. Tandem Rear Axle Temperature Gauge, Rear

Fig. 2.25, ICU4M/ICU4M-2 Instrument Cluster (typical)



10/17/2006 f601009a

Fig. 2.26, 10-Key Keypad

- Clear unused or obsolete data, using the reset function of the SET/RESET key.
- Record significant data using the event key (if a data logging unit is installed).
- Acknowledge (diamond button), cancels roll stability alarm (RSA).

Buzzer and Chime

The buzzer sounds for three seconds during the self-test at start-up, and when the following conditions exist:

- low air pressure
- low oil pressure
- high coolant temperature
- the parking brake is applied and the vehicle is moving at a speed of at least 2 mph (3 km/h)
- VORAD failures (e.g., WARNING HEADWAY FAILURE)
- Some roll stability (RSA) messages

A friendly chime sounds when the parking brake is off and the door is open, or when the headlights are on and the door is open.

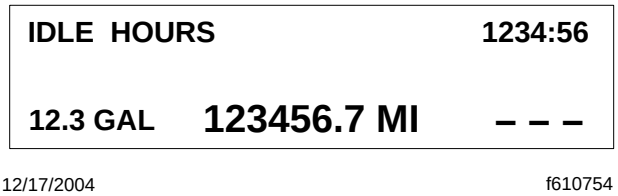
Ignition Sequence

When the ignition key is turned on, the ICU4M/ ICU4M-2 begins a self-test. During the first half of this process, the following events occur. Observing these events is a good way to make sure the ICU4M/ ICU4M-2 is functioning properly.

- All gauges controlled by the cluster sweep to full scale and return.
- All display segments of the message center turn on and then turn off.
- The buzzer sounds for three seconds.
- The battery voltage, low air pressure, and parking brake warning lights come on and then go off.
- The fasten seat belt warning light illuminates for 15 seconds.

In the second half of the self-test, the software revision level of the ICU4M/ICU4M-2 displays on the message center, followed by the active faults, if any.

When the self-test is complete, the fasten seat belt screen displays if the engine is not running. If the engine is running, the idle hours screen displays. See **Fig. 2.27** for the idle hours screen (odometer display).



NOTE: On vehicles with automated manual transmission, the three digits on the lower right are reserved for current gear information.

Fig. 2.27, Idle Hours Screen

Alert Screens

Alert screens come on whenever the condition occurs. They appear when the vehicle is moving; they override the regular screen display. They are warnings, cautions, or other messages that require the driver's attention, but not all of them are critical to the operation of the vehicle. Warning messages always display at full brightness.

More important messages take priority over less important messages. The order of importance, or priority, is:

1. Eaton VORAD and RSA warnings (if so equipped)
2. Park brake on (with the vehicle moving)
3. Park brake off (with door open)
4. Low oil pressure, high coolant temperature
5. Hard brake warnings (if equipped with RSA)
6. Low voltage
7. Turn signal on
8. Incoming instant or Qualcomm messages
9. Service warnings
10. No datalink activity

"Incoming Message" Screen

On vehicles with an onboard communications system like Truckweb or Qualcomm, this screen activates whenever a message is received. "Incoming Message" appears on the message display screen.

NOTE: The "Incoming Message" screen also displays during the ignition sequence if a message is available.

This message displays for a preset time period and then disappears. It returns after the preset interval until it is dismissed by pressing any key on the keypad.

"Parking Brake On" Screen

This warning message and an alarm tone come on whenever the parking brake is applied and the vehicle is moving faster than 2.5 miles per hour or the clutch has been depressed. The word "Warning" flashes on the message display screen above the message "Parking Brake On." The screen and alarm tone go away only when the parking brake is released. See **Fig. 2.28**.

"Low Oil Pressure" Screen

This warning message and an alarm tone come on whenever the oil pressure falls below the minimum oil pressure specified by the engine manufacturer, whether the vehicle is idling or in motion. The word "Warning" flashes on the message display screen

Fig. 2.28, Parking Brake On Screen

above the message "Low Oil Pressure." To dismiss the message, press any key on the keypad.

NOTE: If there is more than one alert message to display, pressing any key takes you to the next message and so on until all the messages have been received.

If low oil pressure is detected during the ignition sequence, it displays as an active fault and the alert screen does not appear.

After 30 seconds, this message displays again and can be dismissed as before by pressing any key.

"High Coolant Temp" Screen

This message and an alarm tone come on whenever the engine coolant temperature exceeds a preset point specified by the engine manufacturer (see the engine manual for this temperature). The word "Warning" flashes on the message display screen above the message "High Coolant Temp."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Low Voltage" Screen

On some vehicles, this message and an alarm tone come on whenever a low voltage condition is detected by the instrumentation control unit. The word "Warning" flashes on the message display screen above the message "Low Voltage."

"Turn Signal On" Screen

This warning message (the alarm tone is optional) comes on whenever the turn signal remains on beyond a preset time or distance traveled. The word "Warning" flashes on the display screen above the message "Turn Signal On."

To dismiss this message, either turn off the turn signal or press any key on the keypad.

Service Warnings

Service warning screens display during the ignition sequence and indicate that a service interval has been reached or exceeded and maintenance is required. The messages may indicate the number of miles or hours until the next service or, once passed, the number of miles or hours ago that maintenance should have been performed. The messages read "X Miles To Next Service," "X Hours To Next Service," "Service Was Due X Mi Ago," and "Service Was Due X Hr Ago." The letter X represents the number of miles or hours programmed. The ICU4M/ICU4M-2 can be programmed using ServiceLink to generate service warnings in either miles or hours, but not both.

"No Datalink Activity" Screen

The "No Datalink Activity" screen comes on whenever the datalink is not receiving data.

If the condition persists, take the vehicle in for service as soon as possible to discover the cause of the problem.

Automated Manual Transmissions

The ICU4M/ICU4M-2 can display current gear information for vehicles with automated manual transmissions (AMT). The last three digits at the far right on the lower line are reserved for this information. On the diagrams for the stationary access screens, this is indicated by the legend "AMT."

If there is a need to shift, one digit displays an arrow, either up or down depending on the shift direction. The other two digits display the current gear.

On vehicles with conventional manual or automatic transmissions, these three digits do not display.

Direct Access Screens

The driver can also override the regular screen display at any time by pressing the keypad to display one of the direct access screens.

- Press the TRIP key for the "Trip miles and Trip Hours" screen, and "Roll Count and Hard Brake Count" screen.
- Press the FUEL key for the "Fuel Used and Average MPG" screen.

- Press the LEG key for the "Leg miles and Leg Hours" screen, and "Roll and Hard Brake" Screen.

Data for each of the above screens can be reset (cleared). To reset, display the screen and push the Set/Reset key twice within six seconds (a confirmation screen will display after you press the key once).

NOTE: Resetting "Trip Miles and Hours" also resets "Leg Miles and Hours" and "Roll Counts".

Press the TEMP key to display the outside air temperature.

Stationary Access Screens

The stationary access screens provide a wealth of information. Using the general keys (arrow keys) to scroll up, down, and to the left or right, you control the following functions:

- trip information including trip miles and hours, idle hours and average speed, and leg miles and hours
- fuel information including fuel used, fuel economy, and idle and PTO fuel usage
- engine information including engine miles and hours, engine and PTO gallons, and oil level (on some Mercedes engines, if equipped and enabled)
- diagnostic information including J1587 fault codes
- service information including mileage or time to next service
- setup information of various kinds
- vehicle information including datalink status, ICU serial number, and software version

Many features of the ICU4M/ICU4M-2 are user-programmable. The set function of the set/reset key can be used to program the display. In addition, the reset function of the set/reset key can be used to reset the counters for trip and fuel information, and to reset fault code screens after the faults have been cleared. See **Fig. 2.29** for information on how to use the set/reset key.

With the parking brake released, only the odometer and alert screens can be displayed. Park the vehicle and set the parking brake to display additional screen functions.

Trip Information

Trip information allows you to view trip mileage and time, time spent idling, average miles per hour, leg mileage and time, and roll count if the vehicle has roll stability. See **Fig. 2.30**.

When the odometer is displayed, press the right arrow key to display the trip information screen. Press the right arrow key again to display trip miles, average miles per hour, and leg miles, in that order. This sequence completes the trip information screens.

From here, press the right arrow key again to return to the trip information screen. From any trip information screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to go on to fuel information.

Fuel Information

Fuel information allows you to view total fuel usage since the last reset, fuel mileage, and fuel consumed while idling or running the PTO. See **Fig. 2.31**.

From the trip information screen, press the down arrow key to display the fuel information screen. Press the right arrow key to display fuel used and average miles per gallon, and again to display idle gallons and PTO gallons. This sequence completes the fuel information screens.

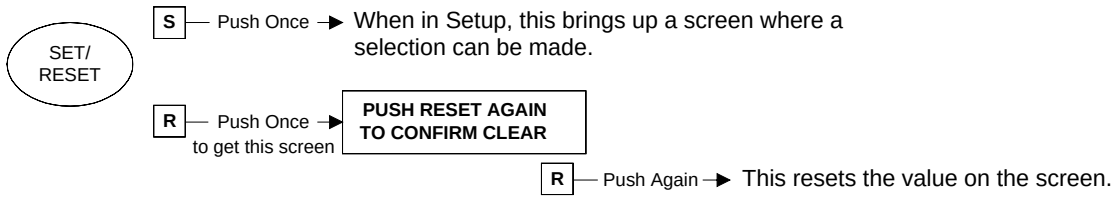
From here, press the right arrow again to return to the fuel information screen. From any fuel information screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to go on to engine information.

Engine Information

Engine information allows you to view total engine mileage and hours, fuel consumption for the engine and PTO, and engine oil level (where installed). See **Fig. 2.32**.

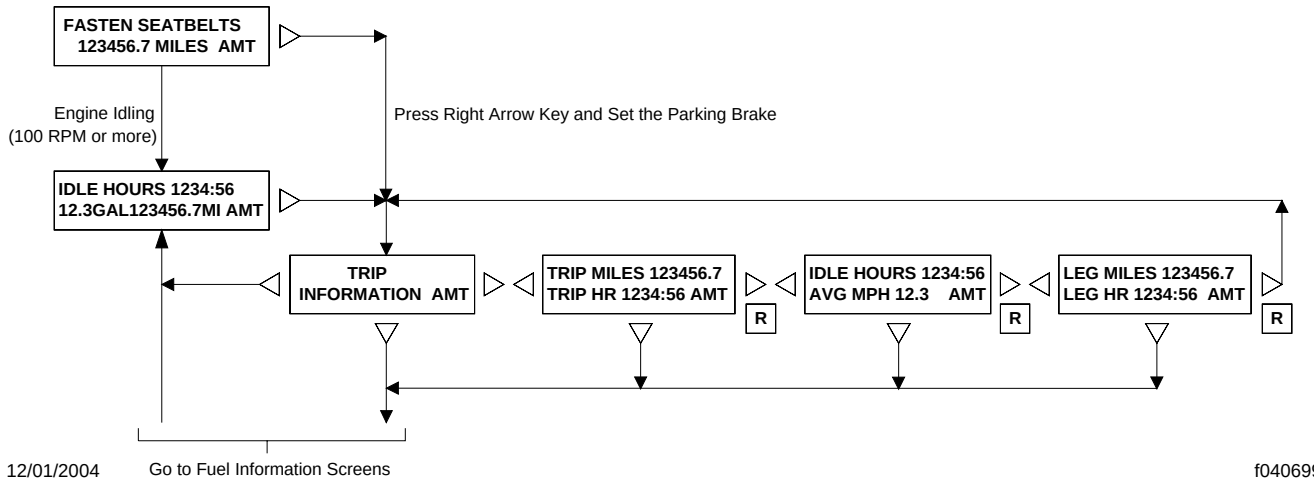
NOTE: Engine oil level is an optional function available on vehicles with Mercedes-Benz engines.

From the fuel information screen, press the down arrow key to display the engine information screen. Press the right arrow key to display, in order, engine miles/hours, engine/PTO gallons of fuel used, and, when installed, engine oil level. This sequence completes the engine information screens.



AMT= Current gear information for automated manual transmissions.

Fig. 2.29, Set/Reset Key Functions



AMT= Current gear information for automated manual transmissions.

NOTE: Metric unit screens are similar.

Fig. 2.30, Trip Information Screens

From here, press the right arrow key again to return to the engine information screen. From any engine information screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to go on to diagnostic information.

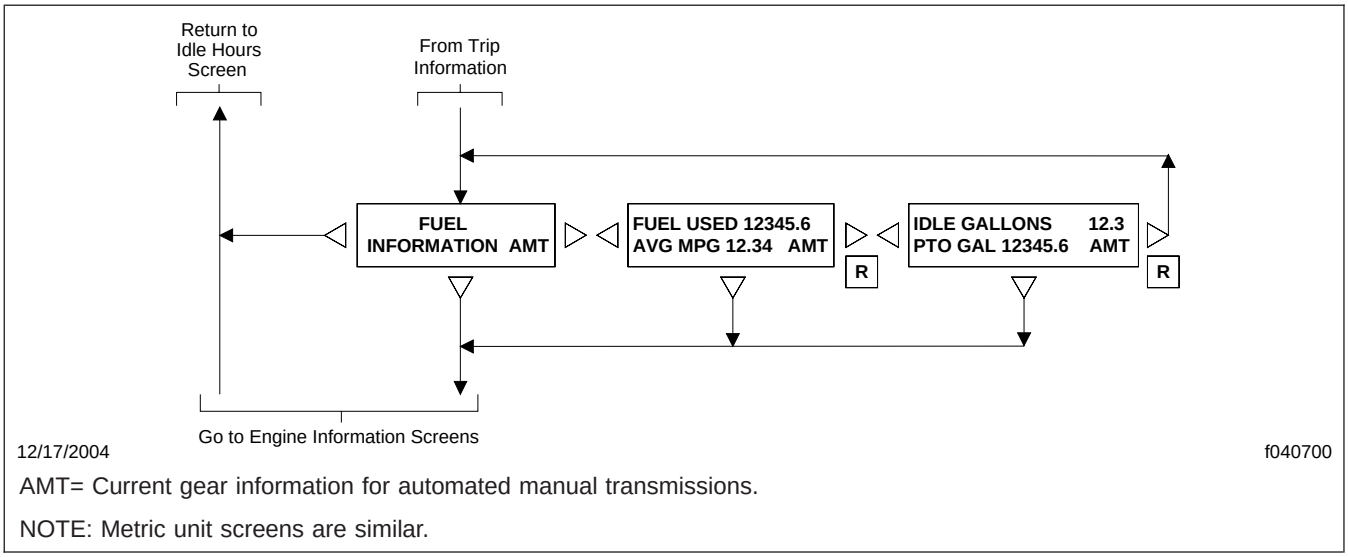
Diagnostic Information

Diagnostic information allows you to view any J1587 fault codes transmitted on the vehicle datalink. The complete fault code is displayed both as a text message and in numbers. Specific fault code information can be displayed only with the vehicle stopped and the parking brake set.

During vehicle start-up, with the parking brake set, the ICU4M/ICU4M-2 displays active fault codes, if any, until the parking brake is released. With an active fault code on display, push the left arrow key to go to the active faults screen (gives the total number of active faults), and again to go to the diagnostic information screen. From here, any of the diagnostic information can be obtained, including information about any fault, active or historical.

NOTE: Historical faults are dash faults only.

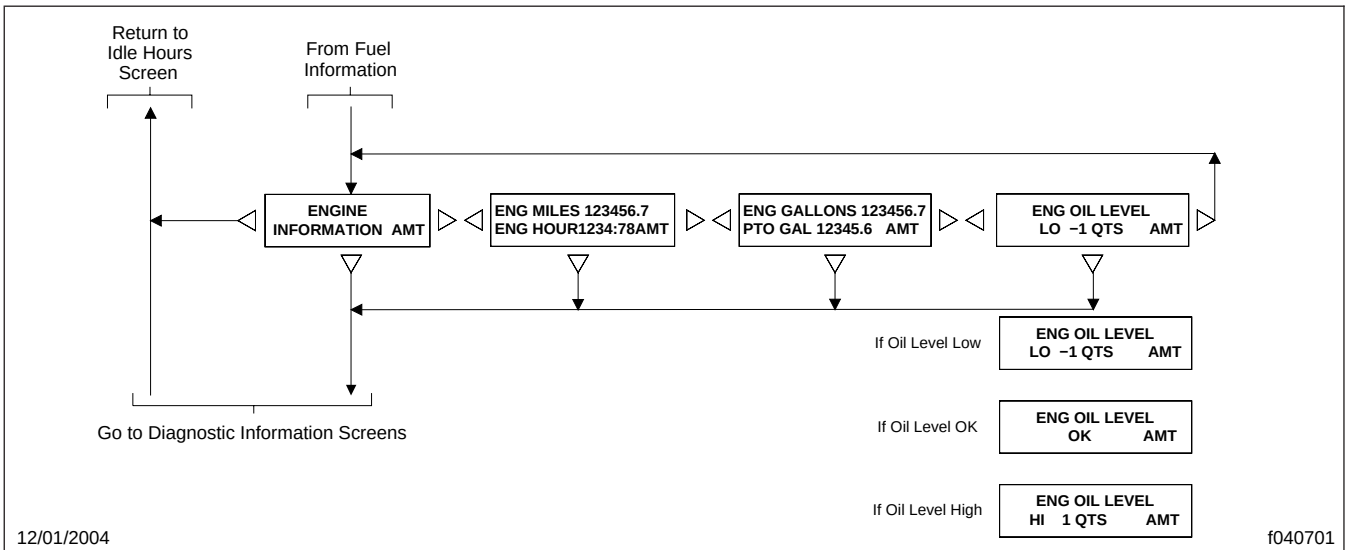
Diagnostic information can also be obtained at any time. From the odometer screen, press the right arrow key once and the down arrow key three times to display the diagnostic information screen. See **Fig. 2.33**.



AMT= Current gear information for automated manual transmissions.

NOTE: Metric unit screens are similar.

Fig. 2.31, Fuel Information Screens


Return to Idle Hours Screen
From Fuel Information
ENGINE INFORMATION AMT
ENG MILES 123456.7 ENG HOUR1234:78AMT
ENG GALLONS 123456.7 PTO GAL 12345.6 AMT
ENG OIL LEVEL LO −1 QTS AMT
If Oil Level Low
ENG OIL LEVEL LO −1 QTS AMT
If Oil Level OK
ENG OIL LEVEL OK AMT
If Oil Level High
ENG OIL LEVEL HI 1 QTS AMT
Go to Diagnostic Information Screens
12/01/2004
f040701

AMT= Current gear information for automated manual transmissions.

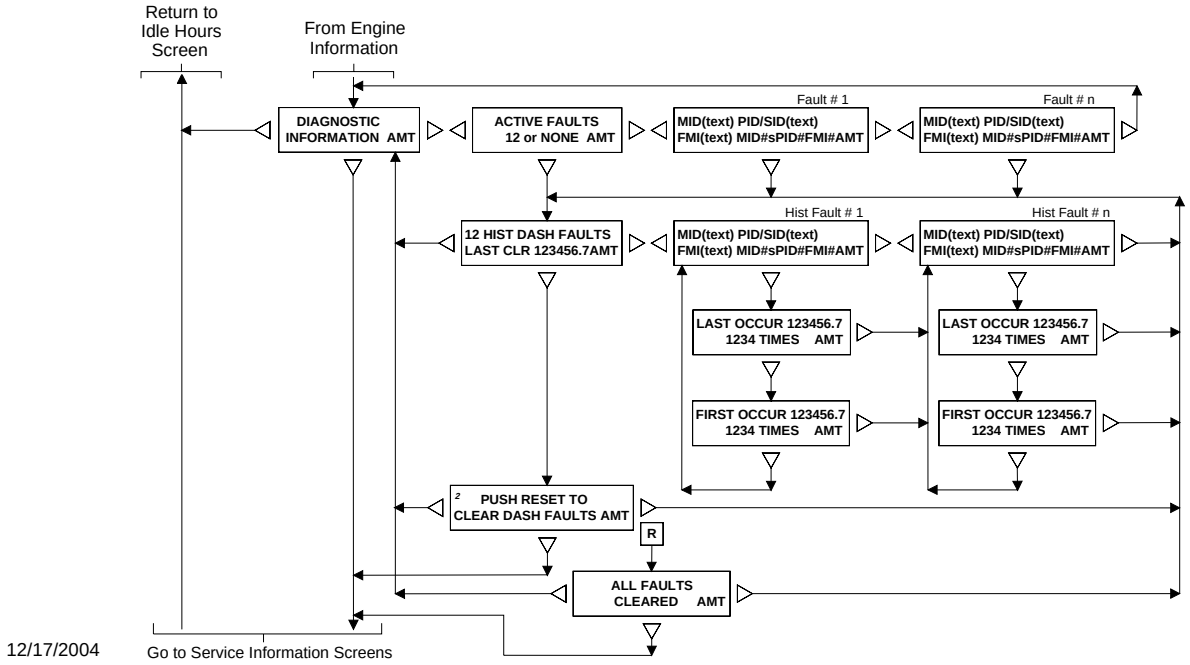
NOTE: Metric unit screens are similar.

Fig. 2.32, Engine Information Screens

Active Faults

Active faults are current problems that require attention. If active fault codes display during start-up or at any other time, make a note of the fault code and text message. Then call an authorized Freightliner service facility for assistance.

From the diagnostic information screen, press the right arrow key to display the number of active faults, then each individual fault, in order, until the end of the list is reached. This sequence completes the active fault diagnostic screens.


Return to Idle Hours Screen
From Engine Information
DIAGNOSTIC INFORMATION AMT
ACTIVE FAULTS 12 or NONE AMT
Fault # 1
Fault # n
MID(text) PID/SID(text) FMI(text) MID#sPID#FMI#AMT
MID(text) PID/SID(text) FMI(text) MID#sPID#FMI#AMT
12 HIST DASH FAULTS LAST CLR 123456.7AMT
Hist Fault # 1
Hist Fault # n
MID(text) PID/SID(text) FMI(text) MID#sPID#FMI#AMT
MID(text) PID/SID(text) FMI(text) MID#sPID#FMI#AMT
LAST OCCUR 123456.7 1234 TIMES AMT
LAST OCCUR 123456.7 1234 TIMES AMT
FIRST OCCUR 123456.7 1234 TIMES AMT
FIRST OCCUR 123456.7 1234 TIMES AMT
2 PUSH RESET TO CLEAR DASH FAULTS AMT
R
ALL FAULTS CLEARED AMT
12/17/2004
Go to Service Information Screens
f040702

AMT= Current gear information for automated manual transmissions.

NOTE: With less than 254 miles on the odometer, clearing historical faults also clears the memory of the electronic unit reporting the fault.

Fig. 2.33, Diagnostic Information Screens

IMPORTANT: Do not attempt to clear active faults. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

From here, press the right arrow again to return to the diagnostic information screen. From any active fault diagnostic screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to go on to historical fault information.

Historical Faults

Historical faults (dash faults only) are kept in the ICU4M/ICU4M-2's memory after the active fault has been cleared. The data are useful for situations where the same fault recurs over time, to indicate an underlying problem that may otherwise escape attention.

From the diagnostic information screen, press the down arrow key to display the historical faults information screen. Press the right arrow key again to display each individual historical fault, in order, until the end of the list is reached. From any historical fault screen, press the down arrow key to scroll through the occurrence data for each fault. This sequence completes the historical fault diagnostic screens.

It is possible to clear historical fault data from the ICU4M/ICU4M-2's memory when the information is no longer needed. When there are less than 254 miles on the odometer, clearing historical faults also clears the memory of the electronic unit reporting the fault.

IMPORTANT: Do not reset historical faults unless you are sure that the data will not be needed in the future. It is not possible to clear particular historical faults: either all the data are cleared, or none.

To clear historical faults, press the set/reset key. When the message "all faults cleared" appears, all the historical fault data have been cleared. From this message, press the left arrow key to return to the diagnostic information screen, the right arrow key to

return to the historical faults information screen, or the down arrow key to go on to service information.

Service Information

Service information allows you to view the next recurring service interval. Service intervals can be expressed in either miles or hours. They can also be inactivated, so they do not display at all. For programming service intervals, look under the heading "Setup Information."

From the diagnostic information screen, press the down arrow key to display the service information screen, if activated. See **Fig. 2.34**.

NOTE: If the service information screen is not activated, the ICU4M/ICU4M-2 will instead display the setup information screen, which can be used to activate service information.

From the service information screen, press the right arrow key to display, in order, the service interval screen and the miles/time remaining before the next service interval. This sequence completes the service information screens.

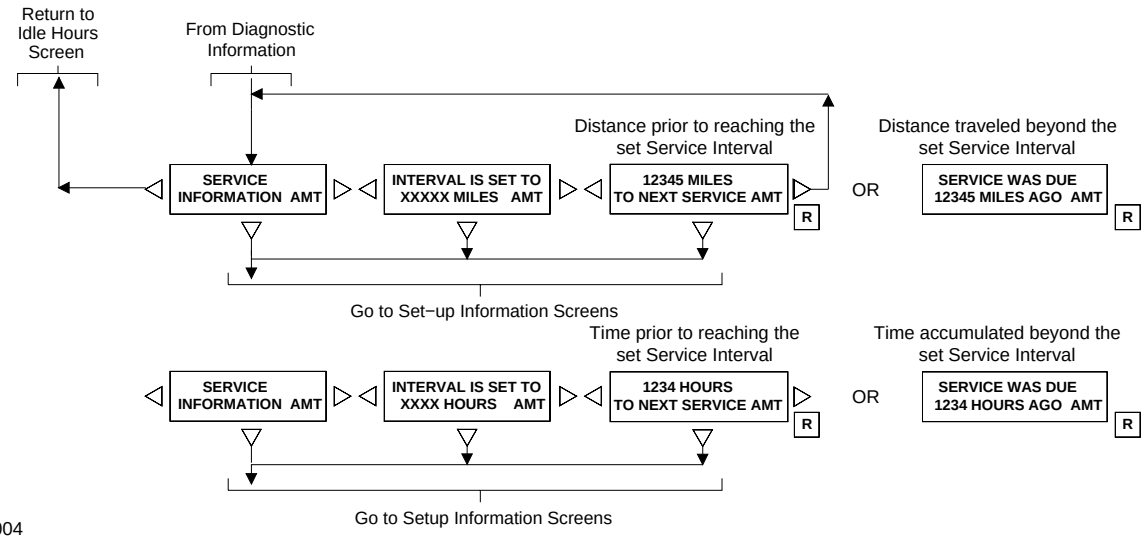
NOTE: If the vehicle has gone past the service interval, the "miles/hours remaining" screen is replaced by the "service was due" screen, followed by the number of miles/hours since the service fell due.

From here, press the right arrow key again to return to the service information screen. From any service information screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to go on to setup information.

Setup Information

Setup information allows you to program various features of the ICU4M/ICU4M-2 environment. Some of the features which can be programmed include:

- service intervals
- target miles per gallon
- LCD lighting
- display brightness
- language
- units of measurement


Return to Idle Hours Screen
From Diagnostic Information
Distance prior to reaching the set Service Interval
Distance traveled beyond the set Service Interval
SERVICE INFORMATION AMT
INTERVAL IS SET TO XXXXX MILES AMT
12345 MILES TO NEXT SERVICE AMT
R
OR
SERVICE WAS DUE 12345 MILES AGO AMT
R
Go to Set−up Information Screens
Time prior to reaching the set Service Interval
Time accumulated beyond the set Service Interval
SERVICE INFORMATION AMT
INTERVAL IS SET TO XXXX HOURS AMT
1234 HOURS TO NEXT SERVICE AMT
R
OR
SERVICE WAS DUE 1234 HOURS AGO AMT
R
Go to Setup Information Screens
12/17/2004
f040703

AMT= Current gear information for automated manual transmissions.

NOTE: Service information screens only appear if the service interval is set to MILES or HOURS in Setup Information. Metric unit screens are similar.

Fig. 2.34, Service Information Screens

- parameters

From the service information screen, press the down arrow key to display the setup information screen. See **Fig. 2.35**. Press the right arrow key to display the setup screen for changing the service interval feature. Press the down arrow key to scroll among the various setup feature screens. This sequence completes the setup feature screens.

From any setup feature screen, press the left arrow key to return to the setup information screen.

To set any feature, press the set/reset key when prompted. A decision screen appears, displaying the decision choices with the current selection flashing. To change the selection, move the left or right arrow key as many times as required until the desired selection is flashing. Then press the down arrow key to leave the decision screen and go to the next setup feature screen. See **Fig. 2.36**.

Service Interval Programming

For service intervals only, there is an extra programming step. From the service interval feature screen, press the set/reset key to display a decision screen for setting service interval units (the choices are miles, hours, or off).

If you select miles or hours on this decision screen, press the down arrow key to go to a second decision screen. This decision screen allows you to select the length of the interval in the units you have chosen (either miles or hours). Once you have selected the interval length, press the down arrow key again to go to the next setup feature screen (target mpg).

If, on the other hand, you select "off" at the selection screen for service interval units (meaning you have turned off service interval information), you go directly to the next setup feature screen (target mpg).

Vehicle Information

Vehicle information allows you to view datalink activity in a dynamic graph format, datalink usage and error rate (datalink status), and ICU4M/ICU4M-2 data, including ICU4M/ICU4M-2 serial number and software revision level. See **Fig. 2.37**.

From the setup information screen, press the down arrow key to display the vehicle information screen. Press the right arrow key to display, in order, datalink activity, datalink status, and ICU4M/ICU4M-2 data.

This sequence completes the vehicle information screens.

From here, press the right arrow key again to return to the vehicle information screen. From any vehicle information screen, press the left arrow key to return to the previous screen in the sequence. Press the down arrow key to return to trip information.

Instrumentation Control Unit, ICU3

Figure 2.38 shows the gauge portion of the dash for vehicles equipped with the ICU3 or ICU3 ‘07.

The ICU3/ICU3 ‘07 electronic dashboard can accept information from the various sensors installed on the vehicle and feed it to electronic gauges. Only air gauges operate mechanically.

There can be up to eight gauges on the driver’s instrument panel (six electronic and two mechanical). The ICU3/ICU3 ‘07 cannot drive gauges located on the auxiliary instrument panel.

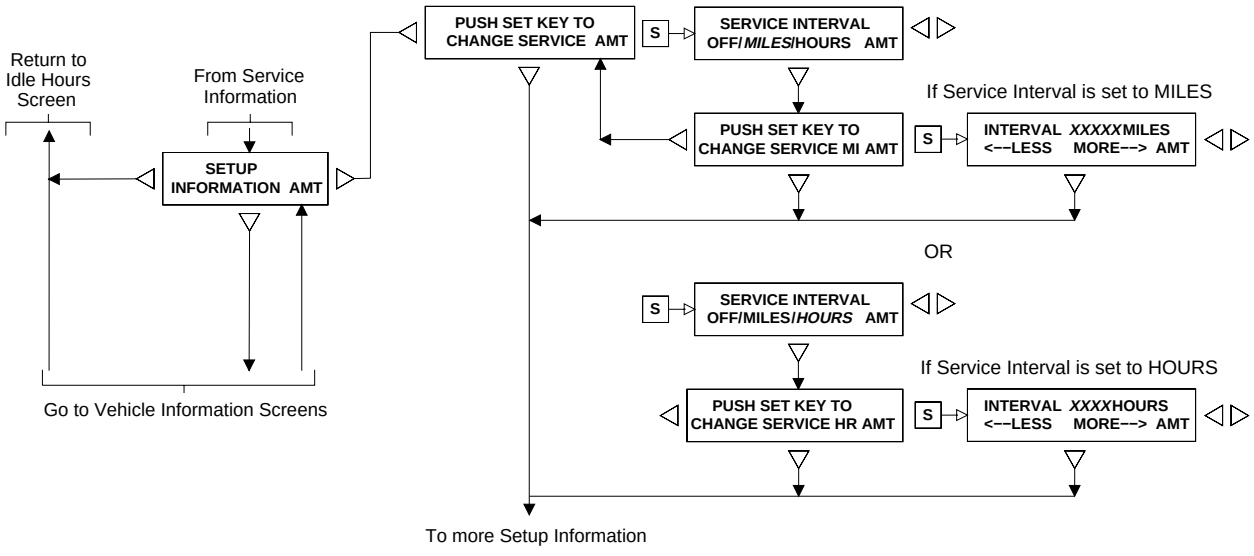
The ICU3 is on vehicles with engines manufactured up until December 31, 2006, and the ICU3 ‘07 is on vehicles with engines manufactured January 1, 2007, or later. They can be differentiated by the ISO icons used on the ICU3 ‘07.

The dash message center is the heart of the ICU3/ICU3 ‘07. It has a set of 26 warning and indicator lights similar to those found on a conventional lightbar, and a dash driver display screen. The dash driver display screen is a one-line by seven-character liquid crystal display (LCD) that normally shows odometer readings.

Warning and Indicator Lights

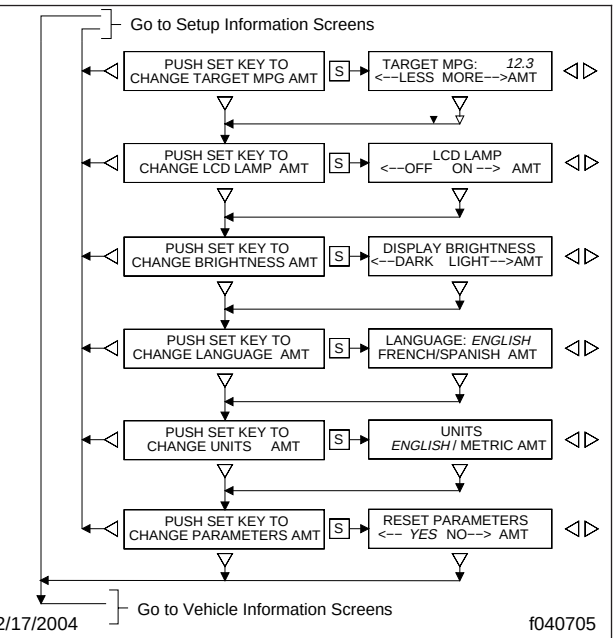
There can be up to 26 warning and indicator lights installed in the ICU3 or ICU3 ‘07. See **Fig. 2.39** and **Fig. 2.40**.

There are four rows of lights in the dash message center. Lights installed in the top row are optional and their positions may vary. The lights in the bottom three rows are installed in fixed positions on all vehicles.



The current selection flashes. Press the left and/or right arrow key(s) to change the selection. To store the changes and exit the screen, press the down arrow key.

Fig. 2.35, Setup Information Screens (for service intervals)



The current selection flashes. Press the left and/or right arrow key(s) to change the selection. To store the changes and exit the screen, press the down arrow key.

Fig. 2.36, Other Setup Information

ICU Ignition Sequence

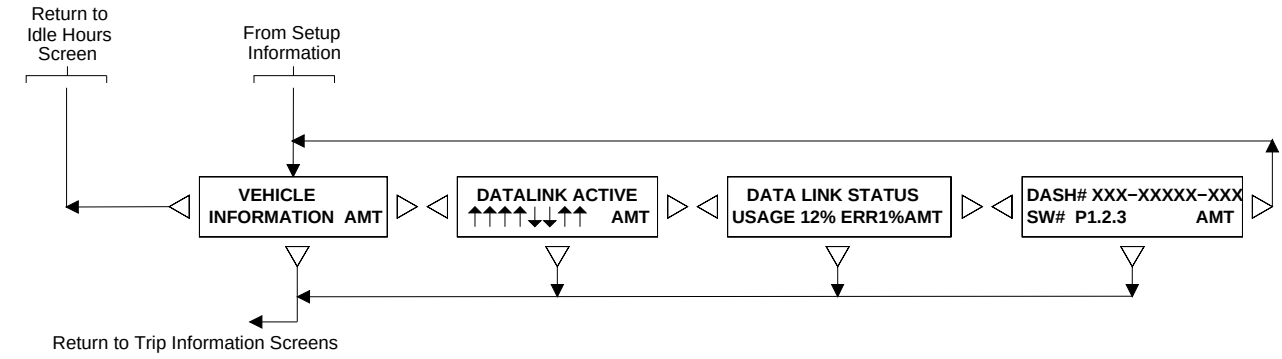
If the headlights are turned on, the screen displays the odometer and waits for the ignition to be turned on.

When the ignition is turned on, all the electronic gauges complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

NOTE: The air gauges do not sweep.

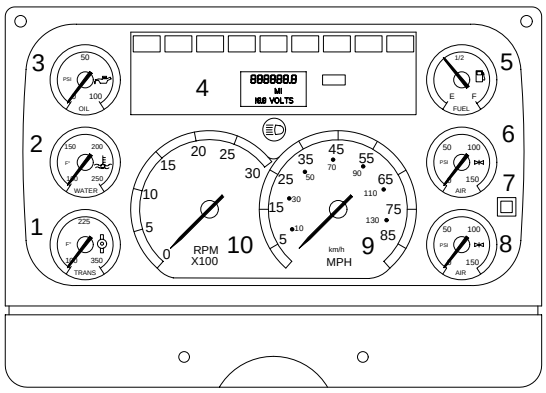
The following lights illuminate during the ignition sequence:

- fasten seat belt warning
- low battery voltage warning
- high coolant temperature warning
- low engine oil pressure warning
- low air pressure warning
- parking brake on indicator
- all engine warning lights, including engine protection, check engine, and stop engine (Cummins only)



AMT= Current gear information for automated manual transmissions.

Fig. 2.37, Vehicle Information Screens



1. Transmission Temperature Gauge
2. Water Temperature Gauge
3. Engine Oil Pressure Gauge
4. Dash Message Center
5. Fuel Gauge
6. Primary Air Pressure Gauge
7. Mode/Reset Push Button
8. Secondary Air Pressure Gauge
9. Speedometer
10. Tachometer

Fig. 2.38, ICU3/ICU3 ‘07 Gauge Layout (typical)

- all ABS warning lights, including wheel spin, tractor ABS, and trailer ABS (if installed)

NOTE: Although the engine and ABS warning lights illuminate during the ignition sequence, they are not controlled by the ICU but by their own system ECU (electronic control unit).

When the ignition switch has been turned on, the ICU performs a self-test, looking for active faults.

During the first half of the self-test, all segments of the display illuminate as follows: "888888.8." The ICU voltmeter display also illuminates, but with the value "18.8." During the second half of the self-test, the software revision level is displayed.

If there are no active faults, the ICU displays the odometer. However, if the ICU has received active fault codes from other devices, it displays them one after the other until the parking brake is released or the ignition switch is turned off. Once the parking brake is released, the ICU displays the odometer again.

See **Fig. 2.41** for the ICU3/ICU3 ‘07 ignition sequence.

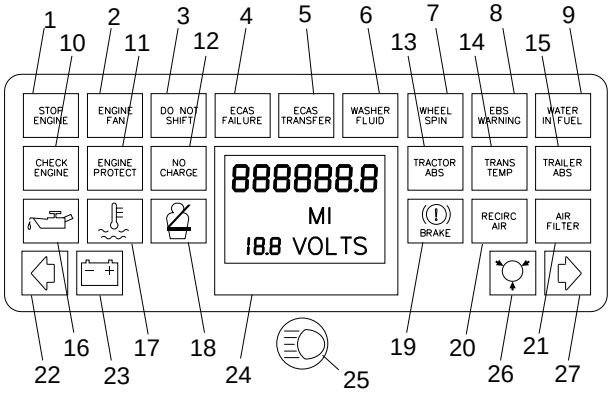
Instrumentation Control Unit, ICU2M

NOTE: The ICU2M is not available on vehicles built after January 1, 2007. It is replaced with the ICU4M.

The ICU2M is an advanced programmable electronic dashboard. It can accept information from the sensors and electronic control units installed on the vehicle and feed it to electronic gauges. Only air gauges operate mechanically.

There can be up to 14 removable gauges on the driver’s instrument panel (11 electronic, one electromechanical, and two mechanical).

The Driver Message Center is the heart of the ICU2M. It has three parts:



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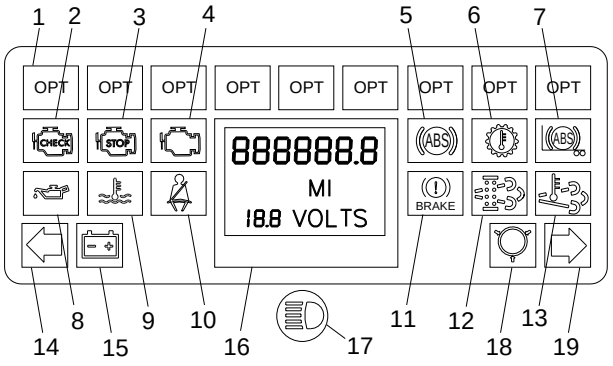
1. Stop Engine Warning
2. Engine Fan On Indicator
3. Do Not Shift Indicator
4. ECAS Failure Warning
5. ECAS Transfer Indicator
6. Low Washer Fluid Indicator
7. Wheel Spin Indicator
8. EBS Warning (optional)
9. Water In Fuel Indicator
10. Check Engine Indicator
11. Engine Protection Warning
12. No Charge Indicator
13. Tractor ABS Warning
14. Transmission Temperature Warning
15. Trailer ABS Warning
16. Low Oil Pressure Warning
17. High Coolant Temperature Warning
18. Fasten Seat Belt Warning
19. Parking Brake On Warning
20. Recirculated Air Indicator
21. Air Restriction Indicator
22. Left-Turn Signal
23. Low Battery Voltage Warning
24. Dash Driver Display Screen
25. High Beams Indicator
26. Low Air Pressure Warning
27. Right-Turn Signal

Fig. 2.39, ICU3 Dash Message Center, Pre-2007



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1. Optional Indicator
2. Check Engine Indicator
3. Stop Engine Indicator
4. Malfunction Indicator Light (MIL)
5. Tractor ABS Indicator
6. Transmission Temperature Indicator
7. Trailer ABS Indicator
8. Low Oil Pressure Warning
9. High Coolant Temperature Warning
10. Fasten Seat Belt Warning
11. Parking Brake On Warning
12. Diesel Particulate Filter (DPF) Status Indicator
13. High Exhaust System Temperature (HEST) Warning
14. Left-Turn Signal Indicator
15. Low Battery Voltage Warning
16. Driver Display Screen
17. High Beam Indicator
18. Low Air Pressure Warning
19. Right-Turn Signal Indicator

Fig. 2.40, ICU3 '07 Dash Message Center, EPA07 Compliant

- a set of 18 warning and indicator lights similar to those found on a conventional lightbar
- a 10-key keypad on the auxiliary instrument panel

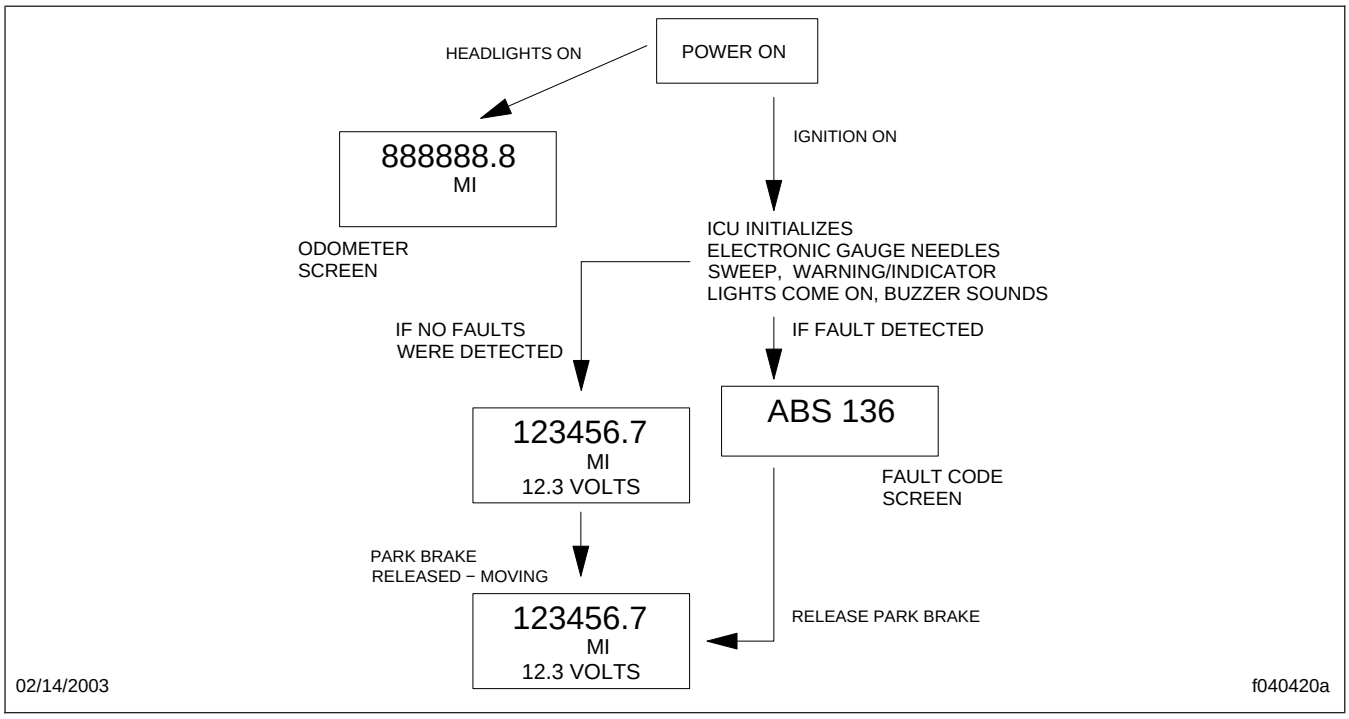


Fig. 2.41, ICU3/ICU3 ’07 Ignition Sequence

- a message display screen

The message display screen is a 2-line by 20-character vacuum fluorescent display that provides a wide range of information to the driver.

Some of the information that can be provided by the message center includes:

- odometer readings
- outside air temperature
- messages from remote locations such as company docks and offices, shipper’s terminals, etc. (if equipped with a communications system, such as Truckweb or Qualcomm®)
- trip information, such as trip miles and hours, idle hours, average mph, and leg miles and hours
- fuel information, such as fuel used and miles per gallon, fuel used idling, and PTO fuel used
- engine information, such as miles, hours, gallons of fuel used, and PTO fuel used
- diagnostic information, such as listings of active faults and troubleshooting information
- vehicle information, such as datalink operation and use data, dash part number, and software number

Some of the advanced features supported by the ICU2M are: Truckweb with instant messages, AMT display, Fuel Use Efficiency Level (FUEL) system display, target miles per gallon (MPG), and brightness control.

Truckweb

With Truckweb and the necessary hardware to support it, specific vehicle information can be transmitted wirelessly over the Internet. Transmitted information includes:

- Global Positioning System (GPS) coordinates
- instant messages
- vehicle mileage
- diagnostics in the form of active fault codes

Transmitted information is viewed by going to the vehicle’s web page using an Internet browser. With

the exception of instant messages, all of the information mentioned above is transmitted to the web page without any action required of the vehicle operator.

Instant Messages

The ICU2M is capable of transmitting and receiving instant messages to and from the vehicle's web page for vehicles equipped with Truckweb.

IMPORTANT: The parking brake must be set in order to send instant messages or to retrieve instant messages from memory. Bring the vehicle safely to a stop out of the flow of traffic and set the parking brake before sending messages or retrieving them from memory.

Receiving Messages

Incoming messages are displayed as they are received, and will be interrupted only by higher priority messages. If interrupted, the instant message being received will display after the higher-priority message is dismissed. Instant messages are stored in memory after being received and dismissed. Up to three messages can be stored in memory at any one time. If a new message arrives and three messages are already in memory the newest message replaces the oldest message.

The size of each incoming message is limited to the total characters that can be displayed on three screens, or 111 total characters. Press the down arrow key on the 10-key keypad, located on the B-panel, to scroll through a message, if necessary.

To acknowledge to the sender that an incoming message has been received, press the "Set/Reset" button. The message then goes into memory, replacing the oldest message there.

To recall a message from memory:

1. Safely stop the vehicle and set the parking brake.
2. With the parking brake set, press the right arrow key on the 10-key keypad to display the "Trip Information" screen.
3. Press the down arrow key until the "Message Information" screen appears.
4. Press the right arrow key until "Read Message" appears.
5. Press the down arrow key until the first message is displayed.
6. Press the down arrow key to continue scrolling through incoming messages stored in memory.
7. To return to the default screen, press the left arrow key as necessary after reading messages.

Sending Messages

Up to 10 different messages can be stored for sending; 5 are fixed and 5 are programmable using ServiceLink.

To send a message:

1. Safely stop the vehicle and set the parking brake.
2. With the parking brake on, press the right arrow key on the 10-key keypad until the "Trip Information" screen appears.
3. Press the down arrow key until the "Message Information" screen appears.
4. Press the right arrow key until the "Send Message Information" screen appears.
5. Press the down arrow key until the first choice message appears.
6. Press the down arrow key again to scroll through the choices. The five programmable messages appear first; the next five messages are the fixed messages. The fixed messages are:
    - "Message Received"
    - "Destination Confirmed"
    - "Please Provide Return Load"
    - "Please Provide Directions"
    - "Send Help"
7. Once the correct message appears, to send it, press the "Set/Reset" key. When the message has been sent, the display will revert to the "Send Message Information" screen.
8. To return to the default screen, press the left arrow key as necessary.

AMT Display

The ICU2M replaces the gauge display on vehicles built with Eaton AutoShift or Meritor SureShift transmissions and Freightliner SmartShift column-mounted shifter. The ICU receives information from the Transmission Control Unit (TCU) and displays it in the last three positions in the bottom right corner of the ICU.

The two right-hand positions are dedicated to alpha/numeric characters, N for neutral, R for Reverse, and 1 through 10 or 18, depending on the transmission configuration. The left-hand position is for the up/down arrow.

When a solid (non-blinking) indication is present in the right position(s), it indicates which gear the vehicle is operating in. When a flashing (blinking) indication is present in the right position(s), it indicates which gear the transmission is attempting to reach. The arrow indication will also be flashing with either an up or down arrow, indicating the need to increase or decrease input shaft speed.

Fuel Use Efficiency Level (FUEL)

If so equipped, the FUEL system continuously monitors fuel usage efficiency and instantly transmits action messages through the Driver Message Center to help the driver get better mileage. The system may suggest a different speed, gear, or throttle position, and will calculate and transmit estimated fuel savings based on the suggested action. It also calculates and displays a bar graph that shows a fuel efficiency score as a percentage of optimum efficiency.

The messages this system displays are:

- "Drive 60 MPH, Gain X MPG"
- "Shift to Next Gear, Gain X MPG"
- "End Idling, Save X Gal/Hr"
- "Drive Steady Speed, Gain X MPG"
- "Move Throttle Slower, Gain X MPG"

In each example, the X value in the statement is variable. The system will estimate and display a numerical savings gain in place of the X.

NOTE: The information provided by the FUEL efficiency system is different than, and should not be confused with, the information available by pressing the FUEL key on the 10-key keypad. The keypad and its direct access keys are described in more detail later in this chapter.

Target MPG

The target MPG feature allows quick and easy checking of fuel economy through the "MPG Graph/Target MPG..Odometer" screen. See **Fig. 2.42**.

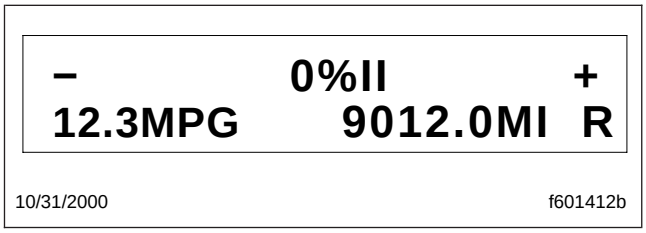


Fig. 2.42, MPG Graph/Target MPG..Odometer Screen

NOTE: Use the LEFT ARROW key to lower the target MPG, and the RIGHT ARROW key to raise it. For more information on how to set target MPG, adjust screen display brightness, change languages, or switch between USC and metric units of measure, see "Setup Information" later in this chapter.

The "Target MPG" area is on the second line of the display, to the left of the odometer. It shows the actual target miles per gallon (MPG).

Example: A reading of "12.3 MPG" indicates that the target MPG is 12.3 miles per gallon.

The "MPG Graph" on the first line of the display gives the same information in dynamic form. The "0%" mark in the center of the line gives the target MPG. Bars showing to the right of the display indicate that short term fuel economy is above the target; bars showing to the left of the display indicate that short term fuel economy is below the target.

Brightness Control

The panel light dimmer switch normally controls the brightness of all panel and gauge lights, including the ICU2M message display screen. With the parking brake set, the ICU keypad can control the brightness of the message display screen independently of the other lights. If the panel lights are set to maximum brightness, the message display screen cannot be brightened any further.

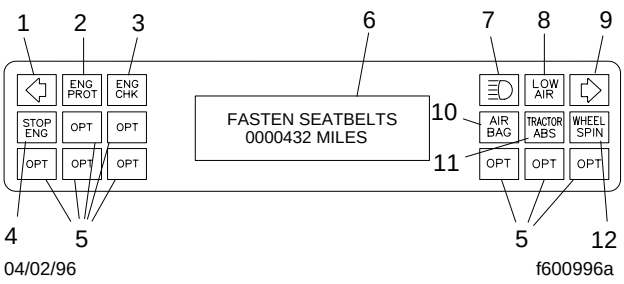
NOTE: Use the left arrow key to dim the message display screen, and the right arrow key to brighten it. For more information on how to set the brightness of the message display screen, see "Setup Information" later in this chapter.

When the parking brake is released, the arrow keys no longer work to change the brightness of the message display screen, but the settings stay in effect unless the headlights are turned on. With the headlights on, the message display screen dims slightly to adjust to nighttime conditions.

Warning and Indicator Lights

There can be up to 18 warning and indicator lights installed in the ICU2M (see **Fig. 2.43**).

- The turn signal lights flash green, on and off whenever the outside turn signal lights are flashing.



Typical installation shown. Location and function of optional lights may vary.

1. Left-Turn Indicator
2. Engine Protection Warning Lamp Indicator
3. Check Engine Indicator
4. Stop Engine Warning
5. Optional Indicator
6. Message Display Screen
7. High-Beam Indicator
8. Low Air Warning
9. Right-Turn Indicator
10. Air Bag Warning
11. Tractor ABS Warning
12. Wheel Spin Indicator

Fig. 2.43, Driver Message Center, ICU2M

- The blue high-beam indicator light comes on when the headlights are on high beam.
- The yellow "Check Engine" (CHK ENG) light comes on to indicate an engine condition such as low coolant level, high coolant temperature, or low oil pressure. It also comes on when a fault is detected or recorded.
- The red "Engine Protection" (ENG PROT) light comes on to warn that the protection system available on the engine has been activated.
- Installed on Cummins engines only, the red "Stop Engine" (STOP ENG) light comes on to warn that the engine is not functioning normally. The vehicle should be pulled over to the side of the road and the engine shut down immediately.
- The red low air pressure (LOW AIR) warning light and buzzer come on whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).
- Depending on options installed, other warning and indicator lights can be installed in the spaces marked "OPT." Available optional indicator lights include: air bag warning, alternator no charge warning, automatic transmission overheat warning, trailer ABS warning, ECAS (electronic suspension) transfer indicator, and ECAS failure warning.

NOTE: The functions of the ABS warning lights are explained under "Meritor WABCO Antilock Braking System (ABS)" later in this chapter.

Keypad

The ICU2M is controlled by a keypad located on the auxiliary dash panel. See **Fig. 2.44**. This keypad, which has 10 keys, can be used for the following tasks.

- Read and send instant messages on vehicles equipped with Truckweb.
- Call up information onto direct access screens.
- Move about from screen to screen while the vehicle is stationary.
- Set up the display.

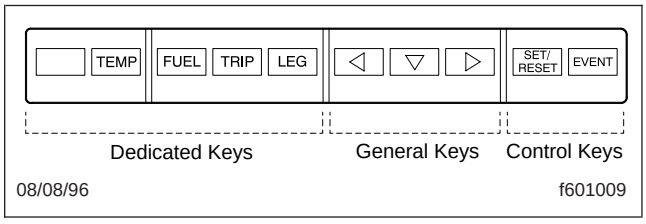


Fig. 2.44, 10-Key Keypad

- Set a target MPG to monitor fuel economy while driving. Press the left arrow key to lower the target MPG and the right arrow key to raise it.
- Set the brightness of the message display screen independently of the panel dimmer switch. Use the left arrow key to dim the display and the right arrow key to brighten it.
- Record significant data using the EVENT key (if a data logging unit is installed).

NOTE: One key is blank and is not usable at this time.

ICU2M Ignition Sequence

If the headlights are turned on, the screen displays the odometer and waits for the ignition to be turned on. See **Fig. 2.45**.

When the ignition is first turned on, all the electronic gauges complete a full sweep of their dials, the warning and indicator lights light up for five seconds, and the buzzer sounds for two seconds.

NOTE: The air gauges and voltmeter do not sweep.

Once the ignition has been turned on, the screen displays the "Freightliner" message. At the same time, the ICU2M conducts a roll call of all the electronic control units (ECUs) installed on the vehicle, looking for active faults.

If there are no active faults, the screen displays the "Fasten Seat Belts/Odometer" screen.

If, however, the ICU2M has received active fault codes or an electronic control unit (ECU) fails to respond to the roll call, it shows the "Active Faults" screen and displays the number of active faults up to a total of eight. If desired, press the right arrow (**Fig. 2.44**) to see the active fault codes. Continuing

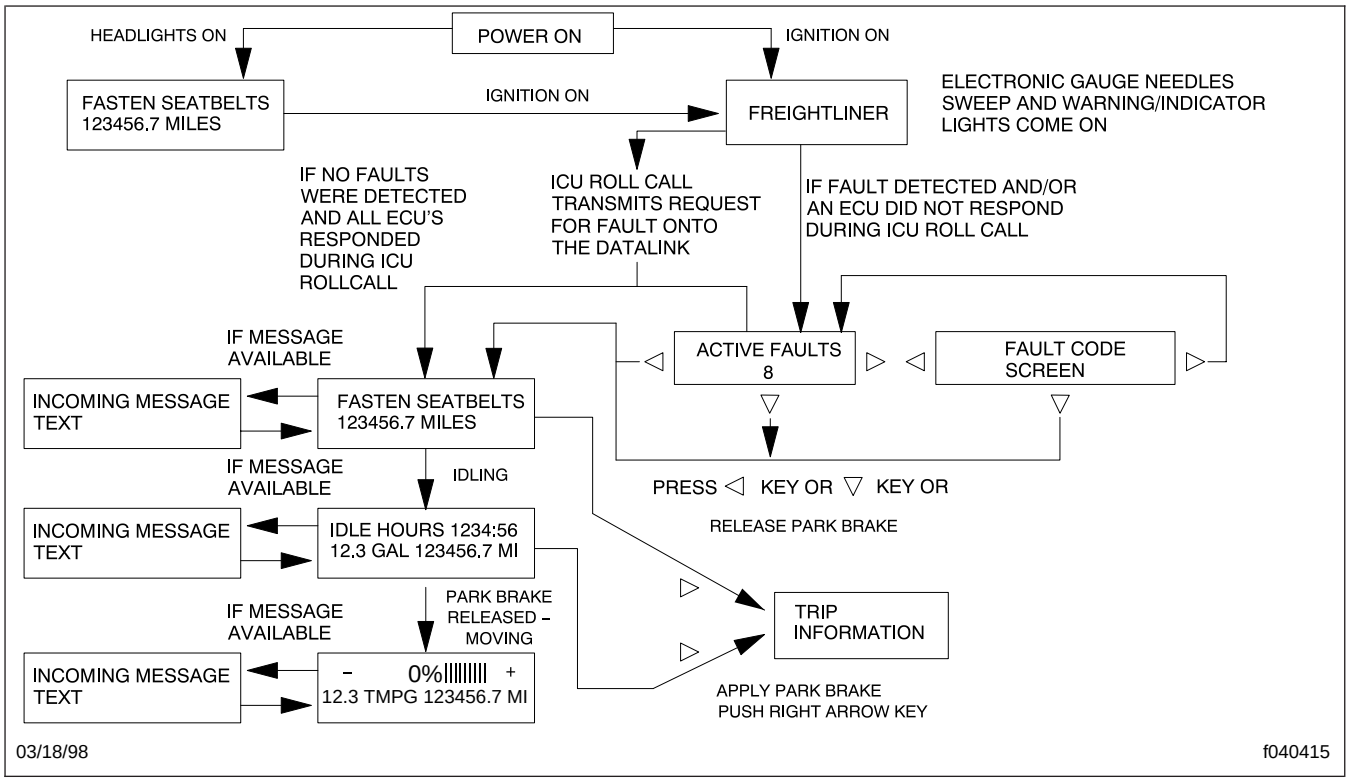


Fig. 2.45, Ignition Sequence, ICU2M

to press the right arrow key will display all additional fault codes (if any).

NOTE: A list of fault codes and definitions can be found in **Section 54.03** of the *Century Class Trucks Workshop Manual*.

To go on, press the left arrow, or if the engine is on, release the parking brake to go on to the "Fasten Seat Belts/Odometer" screen.

Unless the engine is running, the ignition sequence ends with the "Fasten Seat Belts/Odometer" screen.

IMPORTANT: At this point, if the vehicle has a communications system and an incoming message is available, it will be displayed. To dismiss the incoming message, press any key on the keypad.

With the engine idling (the vehicle not moving), the ignition sequence cycles on, and displays the "Idle Hours/Idle Gallons..Odometer" screen. See **Fig. 2.46**.

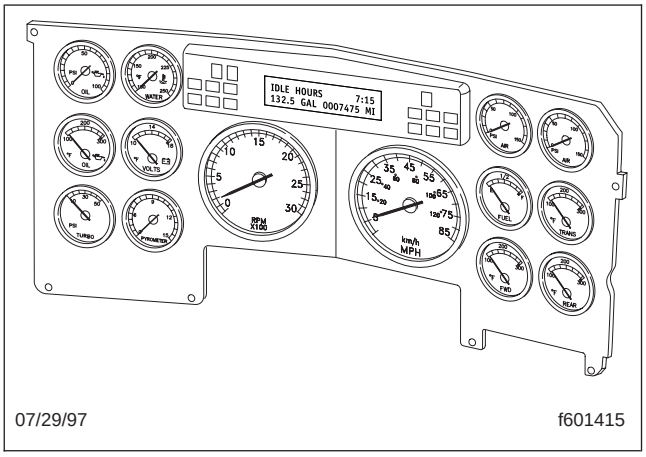


Fig. 2.46, ICU2M At the End of the Ignition Sequence

The Message Display Screen

To understand the information displayed on the message display screen, here is an example of screen layout. On the "Idle Hours/Idle Gallons..Odometer" screen, idle hours are displayed on the top line with the words "Idle Hours" on the left side of the screen and the number of hours on the right. On the bottom line, the number of idle gallons is on the left and the odometer miles are on the right, with a space in between. See **Fig. 2.47**.

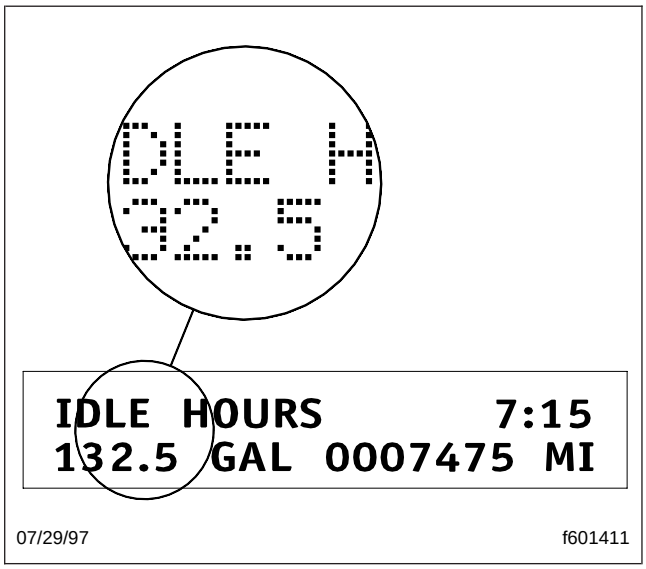


Fig. 2.47, Idle Hours/Idle Gallons..Odometer Screen

Once the parking brake is released (whether the vehicle is moving or not), the regular message screen display is the "MPG Graph/Target MPG..Odometer" screen. The MPG graph is a dynamic display graph demonstrating how the actions of the driver affect fuel economy. The graph moves to the right as fuel economy improves. See **Fig. 2.42**.

NOTE: Press the left arrow key to lower the target MPG and the right arrow key to raise it. For more information on how to set the target MPG, see "Setup Information" later in this chapter.

ICU2M Roll Call

Each time the ignition switch is turned on, the ICU2M roll call function requests data from each ECU on the datalink. If the ECU does respond to this request, the datalink is communicating with that ECU and no fault code is displayed.

NOTE: Each ICU is configured to receive responses from a list of selected ECUs as installed on that particular vehicle.

If the ECU does not respond to this request, the ICU2M displays an active fault code that indicates the datalink is not communicating with that ECU. For a sample fault code and message of this type, see **Fig. 2.48**. For a list of roll call faults, see **Section 54.03** of the *Century Class Trucks Workshop Manual*.

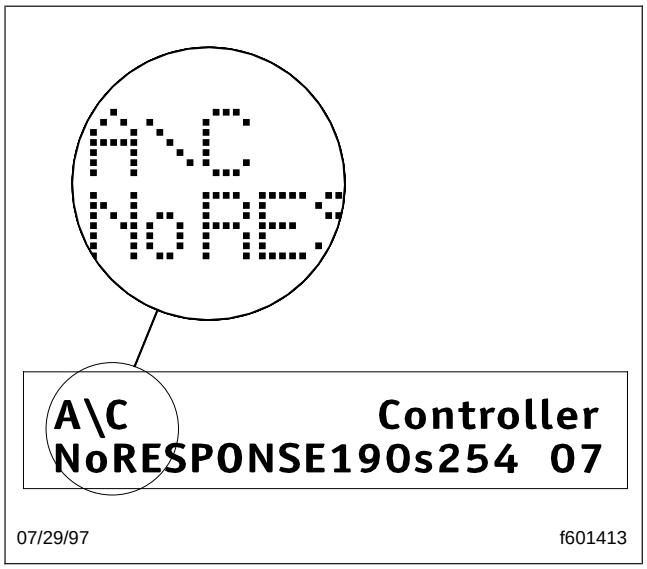


Fig. 2.48, ICU2M Roll Call Fault Code and Message

ICU2M Odometer

The ICU2M odometer is a seven-digit display with one decimal point after the sixth digit allowing it to display tenths of miles (or kilometers).

When first installed, the odometer starts at 0.0 miles (or kilometers). When replaced, the odometer does not start with the engine miles but starts again from 0.0 and cannot be changed up or down.

IMPORTANT: Although the odometer uses data supplied by the engine ECM to update its count, it keeps its own mileage starting from the zero point, which marks where it was first installed.

Alert Screens

Alert screens come on whenever the condition occurs. They appear when the vehicle is moving; they override the regular screen display. They are warnings, cautions, or other messages that require the driver's attention, but not all of them are critical to the operation of the vehicle. Warning messages always display at full brightness.

More important messages take priority over less important messages. The order of importance, or priority, is:

1. Eaton VORAD warnings (if so equipped)
2. Parking Brake On (with the vehicle moving)
3. Low Oil Pressure, High Coolant Temperature, Low Coolant Level, and Low Voltage
4. Alternate Speedometer
5. Recirc Mode Engaged, and Provide Fresh Air
6. Low Fuel Level
7. Turn Signal On
8. Incoming instant or Qualcomm messages
9. Service warnings
10. No Datalink Activity

"Incoming Message" Screen

On vehicles with an onboard communications system like Truckweb or Qualcomm, this screen activates whenever a message is received. "Incoming Message" appears on the message display screen.

NOTE: The "Incoming Message" screen also displays during the ignition sequence if a message is available.

This message displays for a preset time period and then disappears. It returns after the preset interval until it is dismissed by pressing any key on the keypad.

"Parking Brake On" Screen

This warning message and alarm tone come on whenever the parking brake is applied and the vehicle is moving faster than 2.5 miles per hour or the clutch has been depressed. The word "Warning" flashes on the message display screen above the message "Parking Brake On." The screen and alarm tone go away only when the parking brake is released. See **Fig. 2.49**.

Fig. 2.49, Parking Brake On Screen

The "Parking Brake On" screen overrides any other screen message.

"Low Oil Pressure" Screen

This warning message and alarm tone come on whenever the oil pressure falls below the minimum oil pressure specified by the engine manufacturer, whether the vehicle is idling or in motion. The word "Warning" flashes on the message display screen above the message "Low Oil Pressure." To dismiss the message, press any key on the keypad.

NOTE: If there is more than one alert message to display, pressing any key takes you to the next message, and so on until all the messages have been received.

If low oil pressure is detected during the ignition sequence, it displays as an active fault and the alert screen does not appear.

After 30 seconds, this message displays again and can be dismissed as before by pressing any key.

"Low Coolant Level" Screen

This warning message and alarm tone activate whenever the coolant level falls below a preset point. The word "Warning" flashes on the message display screen above the message "Low Coolant Level."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"High Coolant Temp" Screen

This message and alarm tone come on whenever the engine coolant temperature exceeds a preset point specified by the engine manufacturer (see the engine manual for this temperature). The word "Warning" flashes on the message display screen above the message "High Coolant Temp."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Low Voltage" Screen

On some vehicles, this message and alarm tone come on whenever a low voltage condition is detected by the instrumentation control unit. The word "Warning" flashes on the message display screen above the message "Low Voltage."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Faulty Speedo Gauge" Screen

This message is displayed when the system detects a faulty speedometer. This becomes the default screen, and vehicle speed is displayed as a digital readout at the bottom left of the screen. All other screens and functions operate normally.

"Recirc Mode Engaged" and "Provide Fresh Air" Screens

The "Recirc Mode Engaged" screen comes on whenever recirculated air is selected on the fresh/air recirculation switch or the air circulation switch is rotated to the maximum air conditioning position. It displays one time only for seven seconds. It notifies the driver that recirculated air is being used and that fresh air needs to be provided after 20 minutes.

If fresh air is not provided after 20 minutes, the "Provide Fresh Air" message is displayed. It displays for seven seconds every 254 seconds (about every four minutes) until the driver switches to fresh air, either by selecting fresh air on the fresh/air recirculation switch or by rotating the air circulation switch away from maximum air conditioning and to one of the other positions. See **Chapter 4** for detailed operating instructions for the heater/air conditioner.

"Low Fuel Level" Screen

Fuel level is continuously monitored by the ICU. When the fuel level drops to 1/8th full, the word "Warning" flashes on the message display screen above the message "Low Fuel Level."

"Turn Signal On" Screen

This warning message (the alarm tone is optional) comes on whenever the turn signal remains on beyond a preset time or distance traveled. The word "Warning" flashes on the display screen above the message "Turn Signal On."

To dismiss this message, either turn off the turn signal or press any key on the keypad.

Service Warnings

Service warning screens display during the ignition sequence and indicate that a service interval has been reached or exceeded, and maintenance is required. The messages may indicate the number of miles or hours until the next service, or, once

passed, the number of miles or hours ago that maintenance should have been performed. The messages read "X Miles To Next Service," "X Hours To Next Service," "Service Was Due X Mi Ago," and "Service Was Due X Hr Ago." The letter X represents the number of miles or hours programmed. The ICU2M can be programmed using ServiceLink to generate service warnings in either miles or hours, but not both.

"No Datalink Activity" Screen

The "No Datalink Activity" screen comes on whenever the datalink is not receiving data.

If the condition persists, take the vehicle in for service as soon as possible to discover the cause of the problem.

Direct Access Screens

The driver can also override the regular screen display at any time by pressing the keypad to display one of the direct access screens.

- Press the TRIP key for the "Trip Miles and Trip Hours" screen.
- Press the FUEL key for the "Fuel Used and Average MPG" screen.
- Press the LEG key for the "Leg Miles and Leg Hours" screen.

Data for each of the above screens can be reset (cleared). To reset, display the screen and push the Set/Reset key twice within six seconds (a confirmation screen will display after you press the key once).

NOTE: Resetting "Trip Miles and Hours" also resets "Leg Miles and Hours."

Press the TEMP key to display the outside air temperature.

If the vehicle has a data logging unit, press the EVENT key to record data about a significant driving event (engine problem, driving problem, unusual vehicle operation, etc.). Normally, the screen displays "Data Being Recorded."

NOTE: If the memory in the data logger is full, the screen instead displays "Memory Full/Data Not Recorded." If the data logger is not connected or not responding, the screen displays "Data Recorder/Not Responding." If the EVENT key was pressed recently (within the last two minutes), the screen displays "Still Recording/ Last Event."

Stationary Access Screens—Used With Parking Brake Applied

The stationary access screens are a series of informational displays that give trip, fuel, engine, diagnostic, setup, and vehicle information.

For reasons of safety, stationary access screens can be seen only when the vehicle is not moving and the parking brake is applied.

Each set of stationary access screens has a title screen followed by one or more data screens. To move forward and backward through these screens, use the three arrow keys as shown in **Fig. 2.50**, **Fig. 2.51**, and **Fig. 2.52**.

Trip Information

Trip information provides three data screens: "Trip Miles and Hours," "Idle Hours and Average MPH," and "Leg Miles and Hours." See **Fig. 2.50**.

"Trip Miles and Hours" displays the number of miles and hours driven since the start of the trip. At the start of a trip, press RESET (SET/RESET twice) to set trip miles and hours back to zero.

NOTE: Resetting "Trip Miles and Hours" also resets "Idle Hours and Average MPH."

"Idle Hours and Average MPH" displays the hours spent idling and the average miles per hour.

"Leg Miles and Hours" records the number of miles and hours driven since the start of the leg. At the start of a new leg, press RESET to set leg miles and hours back to zero.

NOTE: Resetting "Trip Miles and Hours" also resets "Leg Miles and Hours."

Fuel Information

Fuel information provides two data screens: "Fuel Used and Average MPG" and "Idle Gallons and PTO Gallons." See **Fig. 2.50**.

"Fuel Used and Average MPG" displays the gallons of fuel used since the last reset. At the start of a trip, after refueling, or whenever desired, press RESET (SET/RESET twice) to set fuel used and average miles per gallon back to zero.

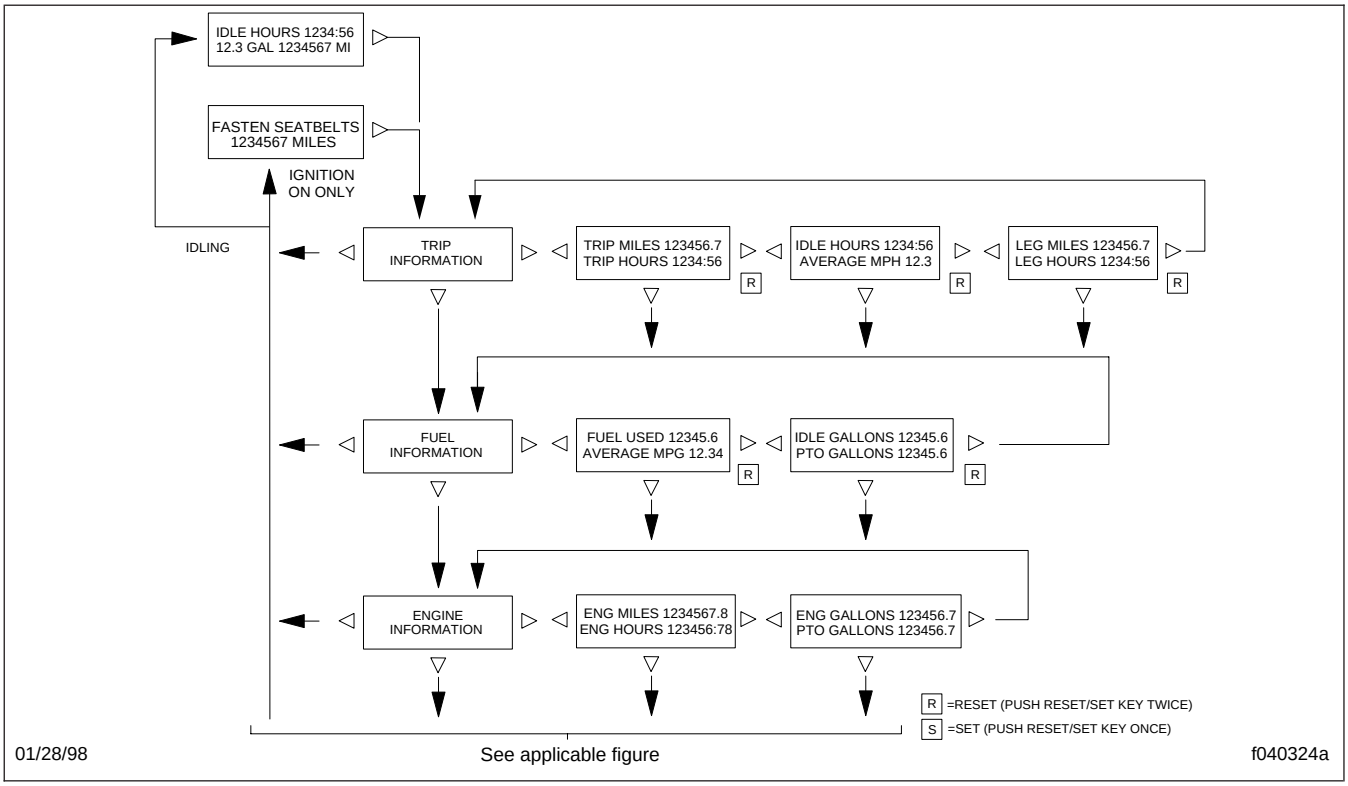


Fig. 2.50, Trip Information, Fuel Information, and Engine Information

NOTE: Resetting "Trip Miles and Hours" does not also reset "Fuel Used and Average MPG" or "Idle Gallons and PTO Gallons." Fuel Information must be reset separately.

"Idle Gallons and PTO Gallons" displays the gallons of fuel used idling and to operate the Power Takeoff unit (if installed). At the start of a trip or whenever desired, press RESET to set idle gallons and PTO gallons back to zero.

Engine Information

Engine information provides two data screens: "Engine Miles and Hours," and "Engine Gallons and PTO Gallons." See **Fig. 2.50** or **Fig. 2.51**.

"Engine Miles and Hours" displays the total miles and hours logged by the engine since installation.

NOTE: Engine information is supplied by the engine Electronic Control Module (ECM). It can be reset using engine diagnostic tools. For more information, see the engine manufacturer's manuals.

"Engine Gallons and PTO Gallons" displays the gallons of fuel used by the engine and PTO since installation.

Diagnostic Information

Diagnostic information provides two sets of data screens: "Active Faults," followed by a separate screen for each fault until all have been shown, and "Historical Dash Faults," also followed by a separate screen for each fault until all have been shown. See **Fig. 2.51**.

"Active Faults" cannot be reset. Active faults can be cleared only by correcting the fault.

"Historical Dash Faults" displays all dash faults since the last reset. The second line of the display shows the mileage the last time faults were cleared.

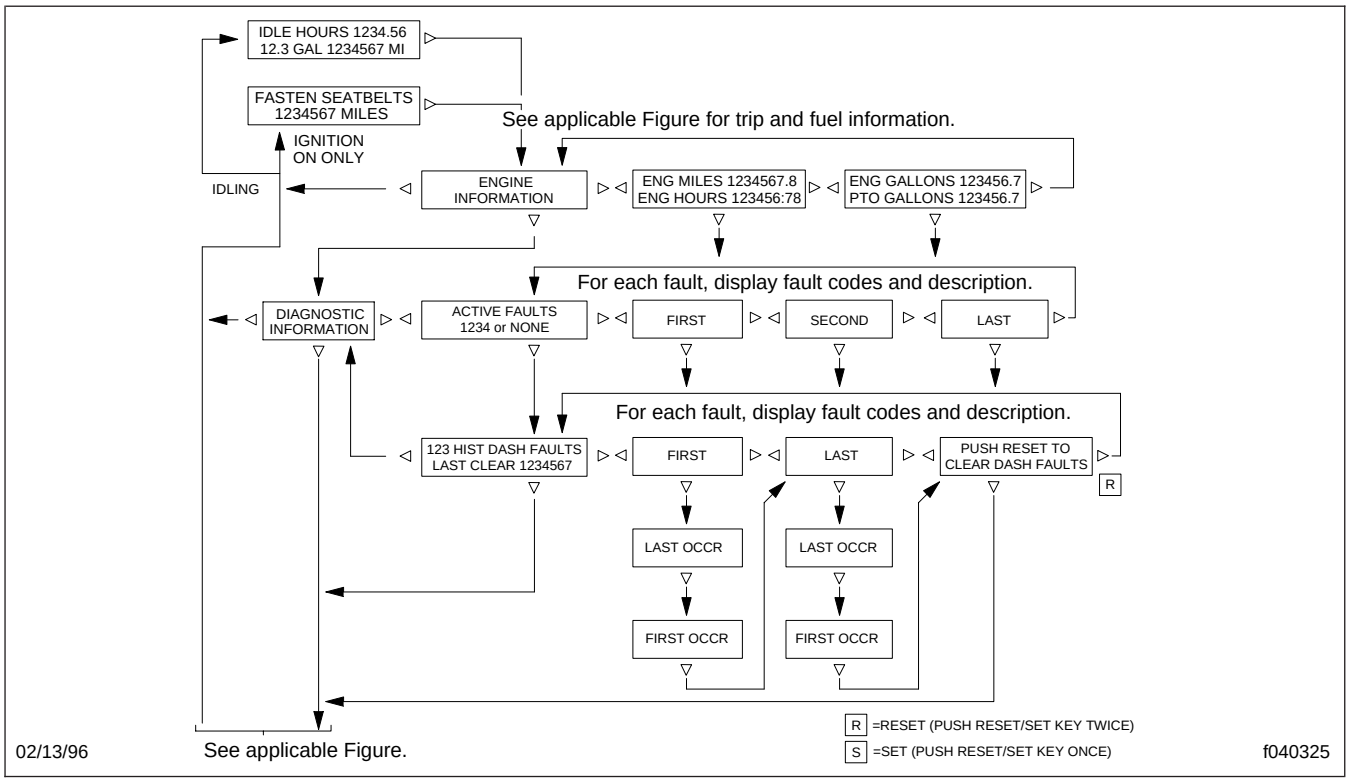


Fig. 2.51, Engine Information and Diagnostic Information

Setup Information

Setup information allows the user to change the target MPG, the brightness of the screen display, the language of the display (English, French, or Spanish), and the units of measurement (English/USC or metric).

When prompted by the screen, press SET (push the SET/RESET key once). The units that are setable will be blinking. Use the arrow keys (left, right, and down) until the display shows the desired setup. Press SET again when finished to save the new settings. See **Fig. 2.52**.

Vehicle Information

Vehicle information displays important information, including datalink activity and status, ICU part number, and software identification number.

The "Datalink Active" screen is a dynamic display that shows if the datalink unit is active at the given time. If all the arrows are pointing down, the ICU2M has not received any information on the datalink since the last time the ignition switch was turned on.

The "Datalink Status" screen is also dynamic, showing current datalink use and error rate. The other screen, which shows the ICU part number and the software identification number, is informational only. See **Fig. 2.52**.

After vehicle information, pressing the DOWN ARROW takes you back to trip information and so on.

Instrumentation Control Unit, ICU2L

The instrumentation control unit, ICU2L is a basic electronic dashboard. It can accept information from the various sensors installed on the vehicle and feed it to electronic gauges. Only air gauges operate mechanically.

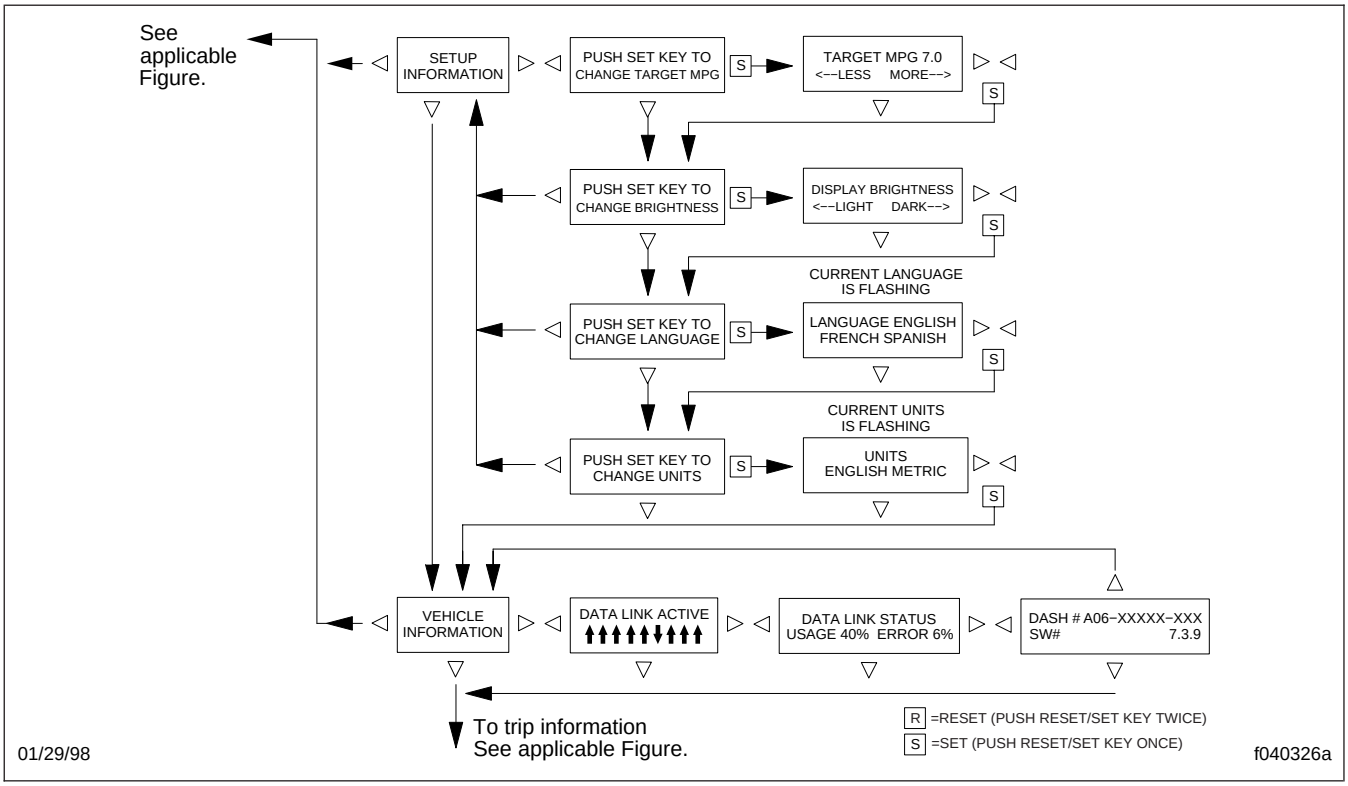


Fig. 2.52, Setup Information and Vehicle Information

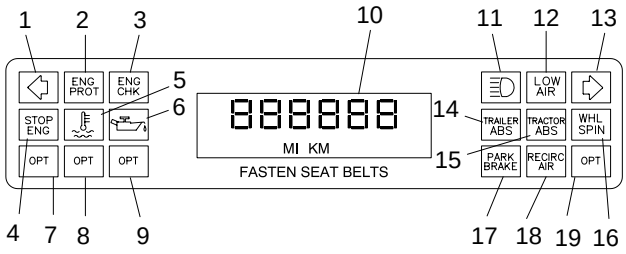
There can be up to 14 removable gauges on the driver's instrument panel (11 electronic, one electro-mechanical, and two mechanical). The ICU2L cannot drive gauges located on the auxiliary instrument panel.

The dash message center is the heart of the ICU2L. It has two parts, a set of 18 warning and indicator lights similar to those found on a conventional light-bar, and a message display screen. The message display screen is a one-line by six-character vacuum fluorescent display.

Warning and Indicator Lights

There can be up to 18 warning and indicator lights installed in the ICU2L. See **Fig. 2.53**.

- The green right- and left-turn signal lights flash on and off whenever the outside turn signal lights are flashing.
- The blue high-beam indicator light comes on when the headlights are on high beam.
- The yellow "Check Engine" (ENG CHK) light comes on if an engine condition exists such as low coolant level, high coolant temperature, or low oil pressure. It also comes on when a fault is detected or recorded.
- The red "Engine Protection" (ENG PROT) light comes on to indicate that the protection system available on the engine has been activated.
- Installed on Cummins engines only, the red "Stop Engine" (STOP ENG) light comes on to warn that the engine is not functioning normally. The vehicle should be pulled over to the side of the road and the engine shut down immediately.
- The red low air pressure (LOW AIR) warning light and buzzer activate whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).
- The red high coolant temperature (thermometer symbol) warning light and buzzer activate whenever the coolant temperature goes above



Typical installation shown. Location and function of optional lights may vary.

1. Left-Turn Indicator
2. Engine Protection Warning Lamp Indicator
3. Check Eng. Indicator
4. Stop Engine Warning
5. High Coolant Temp. Warning
6. Low Oil Pressure Warning
7. Optional Indicator 3
8. Optional Indicator 2
9. Optional Indicator 1
10. Message Display Screen
11. High-Beam Indicator
12. Low Air Warning
13. Right-Turn Indicator
14. Trailer ABS Warning
15. Tractor ABS Warning
16. Wheel Spin Warning
17. Park Brake On Indicator
18. Recirc Air Warning
19. Optional Indicator 4

Fig. 2.53, Dash Message Center, ICU2L

a maximum level specified by the engine manufacturer (see the engine manual).

- The red low oil pressure (oil can symbol) warning light and buzzer activate whenever the engine oil pressure goes below a minimum level specified by the engine manufacturer (see the engine manual).
- The parking brake on (PARK BRAKE) warning light activates whenever the parking brake is engaged.
- The recirculated air (RECIRC AIR) warning light activates whenever the ventilating system is switched to recirculated air.
- Depending on options installed, other warning and indicator lights can be installed in the spaces marked "OPT." The optional indicator lights that are available include: low voltage warning, alternator no charge warning, automatic transmission overheat warning, trailer ABS warning, ECAS (electronic suspension) transfer indicator, and ECAS failure warning.

NOTE: The functions of the ABS warning lights are explained under "Meritor WABCO Antilock Braking System (ABS)" later in this chapter.

ICU2L Ignition Sequence

If the headlights are turned on, the screen displays the odometer and waits for the ignition to be turned on. See **Fig. 2.54**.

When the ignition is turned on, all the electronic gauges complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

NOTE: The air gauges and voltmeter do not sweep.

The following lights go on during the ignition sequence:

- High Coolant Temperature Warning
- Low Engine Oil Pressure Warning
- Low Air Pressure Warning
- Park Brake On Indicator
- All engine warning lights, including Engine Protection, Check Engine, and Stop Engine (Cummins only)
- All ABS warning lights, including Wheel Spin, Tractor ABS, and Trailer ABS (if installed)

NOTE: While the engine and ABS warning lights go on during the ignition sequence, they are not controlled by the ICU2L, but by their own system ECU (electronic control unit).

Once the ignition switch has been turned on, the ICU2L performs a self-test looking for active faults. During the first half of the self-test, all segments of the display illuminate. During the second half of the self-test, the software revision level is displayed.

If there are no active faults, the screen displays the odometer. However, if the ICU2L has received active fault codes from other devices, it displays them one after the other until the parking brake is released or the ignition switch is turned off.

A list of fault codes and definitions can be found in **Section 54.14** of the *Century Class Trucks Workshop Manual*. Once the parking brake is released, the ICU2L displays the odometer again.

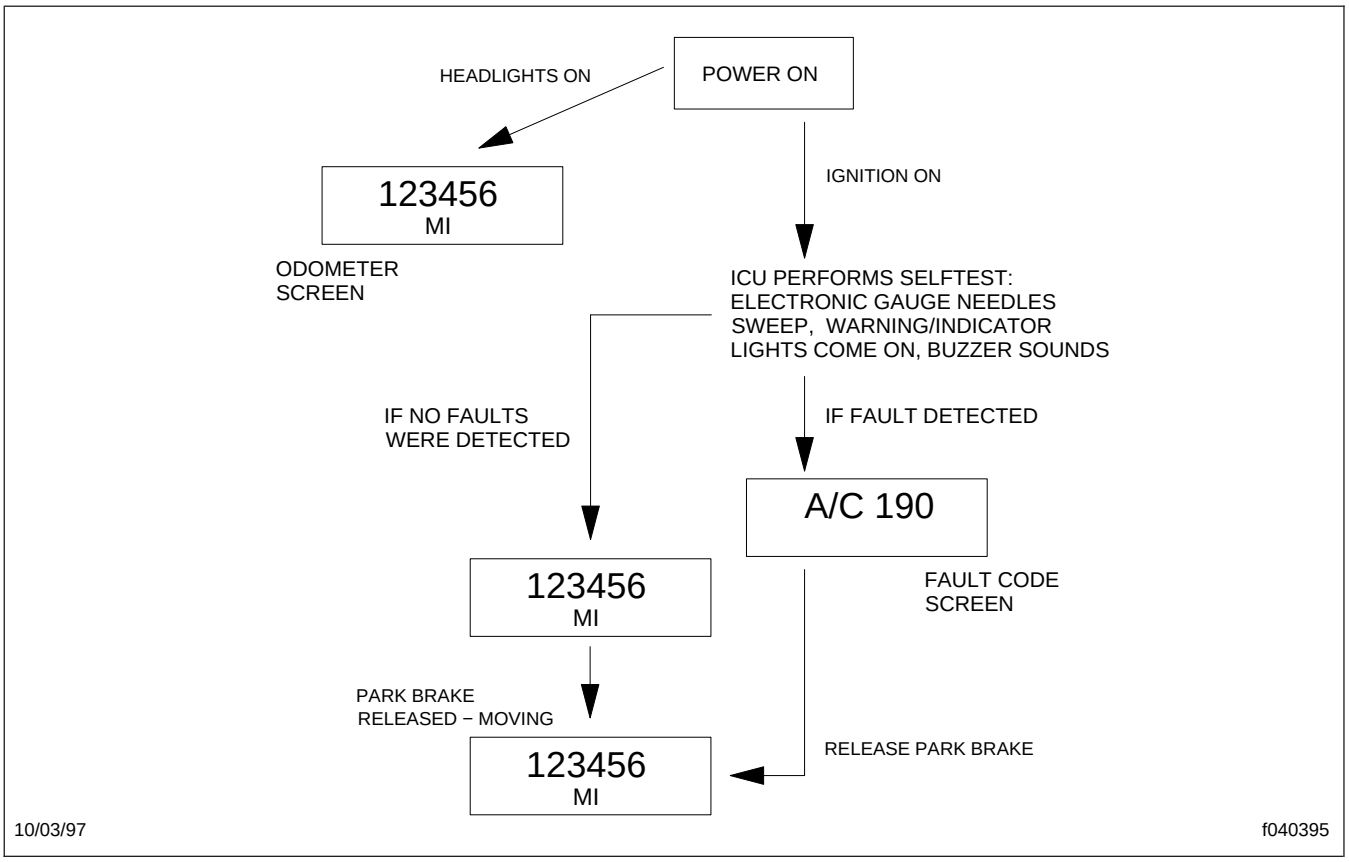


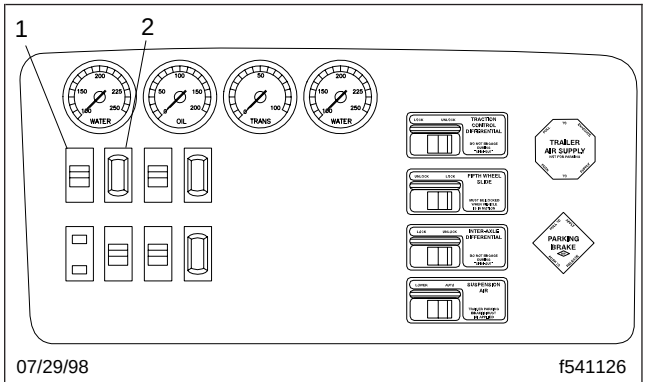
Fig. 2.54, Level II ICU Ignition Sequence

Setting the Units for the Odometer

The ICU2L odometer is a six-digit display without a decimal point. It can display the distance the vehicle has traveled in either miles or kilometers, but it cannot display tenths of miles (or kilometers). The choice of units is selectable using the cruise control switches.

To change the display, shut down the engine and set the parking brake. Turn the ignition switch to the ON position. Turn the cruise control on (cruise control on/off switch). See **Fig. 2.55**.

With the cruise control on, press and hold down the cruise control set switch until the odometer display begins to blink. After about five seconds, the MI display at the bottom of the screen will change to KM (or KM will change to MI, depending on what units were previously set).



To switch from miles to kilometers, turn the cruise control on. Then press and hold down the set switch until the MI display starts to blink.

1. On/Off Switch
2. Set Switch

Fig. 2.55, Cruise Control Switches

Alert Screen

The NODATA screen comes on whenever the datalink is not receiving data. It appears when the vehicle is moving and overrides the regular screen display.

If the condition persists, take the vehicle in for service as soon as possible to discover the cause of the problem.

Meritor™ WABCO® Antilock Braking System (ABS)

The Meritor WABCO Antilock Braking System (ABS) has a tractor warning light (TRACTOR ABS) (**Fig. 2.56**) and, if equipped with automatic traction control (ATC), a wheel spin indicator light (WHEEL SPIN).

After the ignition switch is turned on, the tractor warning light (TRACTOR ABS) and (if equipped) the wheel spin (WHEEL SPN) indicator light come on for about three seconds. After three seconds, the lights go out only if all of the tractor's ABS components are working.

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, repair the ABS system immediately to ensure full antilock braking capability.

The wheel spin indicator light (WHEEL SPIN) comes on if one of the drive wheels spins under power. The light goes out when the wheel stops spinning. A label (**Fig. 2.57**) on the dash explains what actions should be taken when the WHEEL SPIN indicator light comes on.

NOTICE

Axle lock should only be engaged when the vehicle is moving slowly at low throttle. Engagement at high speed or power can damage the axle(s).

Vehicles with electronic engines and ABS may have automatic traction control (ATC). On these vehicles, the ATC system automatically limits wheel spin when power is applied to the drive axles during reduced-traction situations.

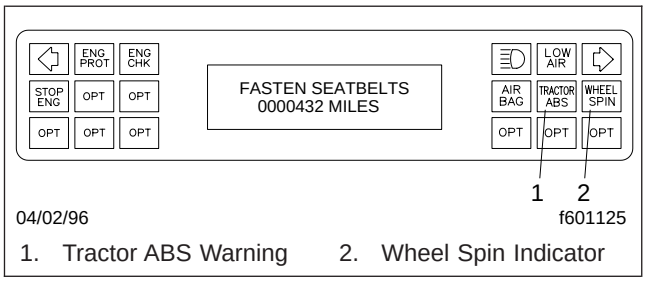


Fig. 2.56, ABS Warning and Wheel Spin Indicator Lights

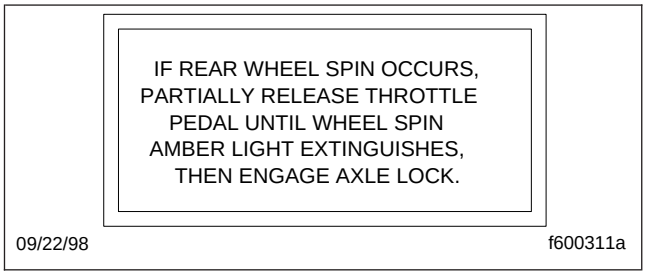


Fig. 2.57, Dash Label

If the vehicle has ATC, there will be a momentary contact rocker switch on the dash labeled NORM/SPIN and ATC.

When the ATC system is in the NORMAL mode, it will apply gentle braking to the spinning wheel, to feed power to the wheel(s) with better traction. If both wheels are spinning, the system will signal the electronic engine to reduce power.

Pressing NORM/SPIN will temporarily allow more drive wheel spin to help burn through a thin layer of ice or to help throw off accumulated mud or snow. SPIN mode is indicated by a flashing WHEEL SPIN light. Pressing NORM/SPIN again will cycle the system back to normal operation.

See the brake system operating instructions in **Chapter 6** for more information.

Collision Warning System (CWS), Eaton VORAD EVT–300 (Stand Alone)

The Eaton VORAD EVT–300 is a computerized collision warning system (CWS) that uses front-mounted and side-mounted radar to continuously monitor vehicles ahead and alongside your vehicle.

The system warns of potentially dangerous situations by means of visual and audible alerts. The system performs in fog, rain, snow, dust, smoke, and darkness. To be detected, objects must be within the radar beam's field of view and provide a surface area that can reflect back the radar beam.

The front-looking antenna assembly transmits radar signals to, and receives them back from, vehicles and objects ahead. This allows the determination of the distance to, relative speed of, and angle to the target of vehicles and objects ahead. The system uses this information to warn the driver of potentially dangerous situations.

A side sensor(s), mounted on the side of the vehicle, also transmits and receives radar signals for a distance of 2 to 10 feet (0.5 to 3 meters), alongside your vehicle. The side sensor can detect unseen vehicles and objects, moving and stationary, adjacent to your vehicle.

IMPORTANT: Ensure that the B-pillar door is closed and secured when the vehicle is in operation. Unintended motion of the B-pillar door will affect the CPU's internal gyroscope. The system may provide an incorrect or unnecessary warning or no warning when one is required.

⚠ WARNING

The Eaton VORAD EVT–300 Collision Warning System (CWS) is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied on to operate a vehicle. Use the system in conjunction with rearview mirrors and other instrumentation to safely operate the vehicle. Operate this vehicle, equipped with the EVT–300 Collision Warning System, in the same safe manner as if the EVT–300 Collision Warning System were not present.

The EVT–300 Collision Warning System is not a substitute for safe, normal driving procedures, nor will it compensate for any driver impairment, such as drugs, alcohol, or fatigue.

The EVT–300 Collision Warning System may provide little or no warning of hazards such as pedestrians, animals, oncoming vehicles, or cross traffic.

On vehicles with SmartCruise, the vehicle will not deactivate cruise control for stationary targets, such as a car stopped in your traveling lane.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

Driver Display Unit (DDU)

NOTE: All system controls are located on the DDU. Indicators to inform the driver about the system's operation are located on both the DDU and the side sensor display. See **Fig. 2.58**.

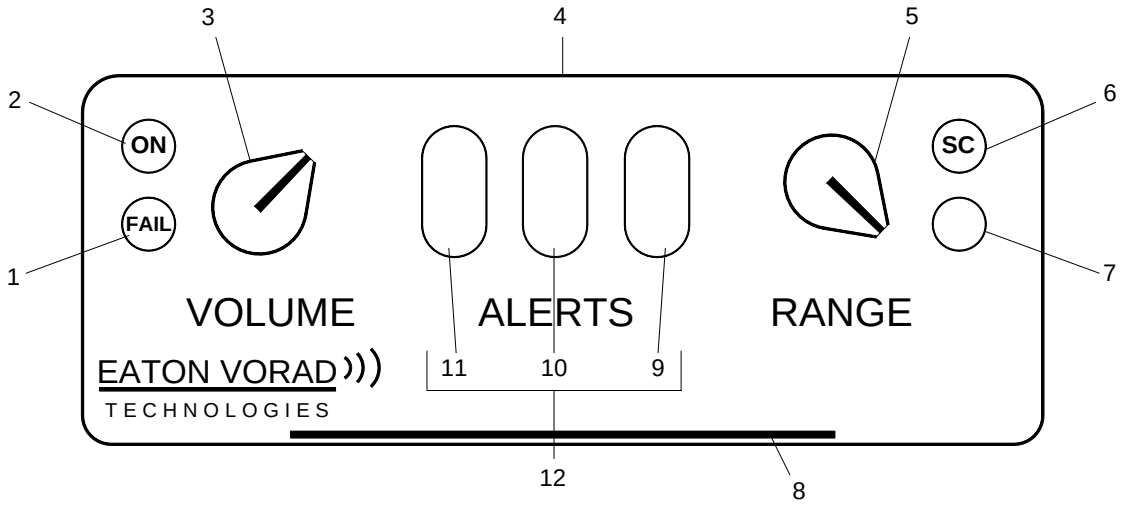
The DDU controls system power, range for vehicle warnings, and speaker volume. At the lower front edge of the DDU, a slot is provided to insert the driver's identification card (). Alert and indicator lights advise of multiple warning levels, system power, system failure, and if so configured, failure of the driver to enter the identification card.

A light sensor automatically adjusts alert and indicator light brightness depending on lighting conditions. A small speaker provides audible alert tones to warn of closing on an object ahead and, when equipped with a side sensor, of objects alongside when the turn signal is activated in preparation for a lane change. Additional tones indicate speaker volume, system failure, driver's card status, and data extraction pass or fail.

1. The green power-on/driver's card status indicator light illuminates when the system is activated and the power-on LED test is complete. If the system is configured to require that the driver's card be read, and it is not, the ON light blinks continuously.
2. Push in the volume control and power ON/OFF knob to turn power on or off. Turn the knob left or right to increase or decrease speaker volume. Press and hold the knob for five seconds and then release it to activate the failure display mode.

NOTE: The system may be configured to have no on/off capability.

3. The speaker is located under the top cover of the DDU. It sounds audible tones to alert the driver to potential hazards. Volume may be restricted to a range above a minimum level.



1. Red System Failure Indicator Light
2. Green Power ON/Driver's Card Status Indicator Light
3. Volume Control and Power ON/OFF Knob
4. Speaker (on top of unit)
5. Range Knob
6. Green SC Indicator Light
7. Ambient Light Sensor
8. Driver's Card Slot
9. Red Alert Light
10. Orange Alert Light
11. Yellow Alert Light
12. Distance/Danger Alert Lights

Fig. 2.58, Driver Display Unit (EVT-300)

NOTE: This electronic parameter can be configured.

4. Rotate the range knob to adjust the first alert detection range to between 3 and 2.25 seconds. Push and hold the knob for 5 seconds to activate the accident reconstruction function and freeze the most recent data in half of the allocated memory.

NOTE: The system may be configured to prevent adjustment of the range levels.

5. The red system failure indicator light illuminates if a system problem is detected. Press and hold the volume control knob for 5 seconds to display fault codes. The fault codes will be blinked out as a pattern of flashes on this indicator light. See **Table 2.2** for fault codes.

6. The green SC indicator light will flash 8 times if the range knob is pressed to store accident reconstruction information. It will also flash 8 times after the system is activated, after the power-on LED test is finished, and if accident reconstruction data was previously stored.

Fault Codes	
Fault Code	**Suspect Failure**
11	Central Processing Unit (CPU)
12	CyberCard
13	Driver Display Unit (DDU)
14	Antenna Assembly
15	Right Side Sensor
16	Left Side Sensor
21	Right-Turn Signal
22	Left-Turn Signal
23	Brake
24	Speed
25	Cruise
31	J1587
32	J1939
33	VBUS
34	DDU Communications
35	Antenna Assembly Communications
41	No Fault or End of Fault Codes

Table 2.2, Fault Codes

7. The ambient light sensor senses lighting conditions and automatically adjusts the intensity of the indicator and alert lights.
8. If the system's configuration requires, insert the driver's identification card in the driver's card slot at the lower front edge of the DDU. A high-pitched tone will sound when the driver's identification card has been successfully read. One low tone will sound if the driver's card has been unsuccessfully read. If so configured, a repeated low tone will sound if the system is on and the requested driver's card has not been inserted.
9. The yellow alert light illuminates when an object is detected within the system's maximum range of 350 feet (107 meters) on a straight road. Range is reduced in curves by the turn radius of the curve. This light also illuminates when the proximity alarm threshold is crossed.
10. The orange alert light illuminates, along with the yellow alert light, when your vehicle is within a two- to three-second following interval behind another vehicle in the same lane. If you are within a two-second following interval, and closing on the vehicle ahead, a warning tone will also sound.
11. The red alert light illuminates, along with the yellow and orange alert lights, when you are less than one second behind a vehicle. If the vehicle ahead is opening the interval, no tone will sound. If you are closing the interval, double tones will sound. Within a 1/2-second or less following interval, opening or closing, the tones will repeat twice per second.
12. If a stationary vehicle or object, or an object moving at least 20 percent slower than your vehicle, is detected within 220 feet (67 meters) and within 3 seconds, all three alert lights will illuminate and the double tones will sound. This warning overrides all others and is not affected by the range control knob setting.

IMPORTANT: The detection range will be reduced during a sharp turn.

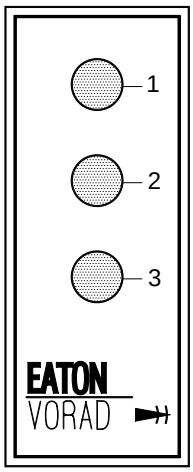
13. If your vehicle is traveling less than 5 mph (8 km/h) and an object is detected less than 15 feet (4.5 meters) in front of your vehicle, and the closing rate is less than 2 mph (3 km/h) but more than 1/2 mph (1 km/h), the yellow alert light will illuminate and a low-frequency double tone will sound.

NOTE: All warnings apply only to objects within the maximum detection range and in your lane. Proximity alert tones and vehicle-closing 1- to 2-second following interval tones are configured items. All tones are disabled in sharp turns or when the brakes are applied. If the configuration permits, the 3-second alert level may be adjusted with the range control knob. A single low-frequency tone sounds when a system failure is detected. A medium-frequency tone sounds when the volume control level is changed. Successful downloading of Vehicle Information Management System (VIMS) data will cause a double tone to sound. Unsuccessful downloading will cause a low-frequency tone to sound.

14. A failure of the side sensor(s) will cause a continuous red light on the side sensor display to appear.

Side Sensor Display

1. The yellow indicator light (**Fig. 2.59**) illuminates continuously when no vehicle is detected by the side sensor(s).



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1. Red Alert Light (vehicle or object detected)
2. Ambient Light Sensor
3. Yellow Indicator Light (no vehicle or object detected)

Fig. 2.59, Side Sensor Display

2. The ambient light sensor senses lighting conditions and automatically adjusts the intensity of indicator and alert lights.
3. The red alert light illuminates when objects are detected by the side sensor(s). If the right turn signal is activated and the side sensor detects an object, the red alert light will illuminate and the DDU speaker will sound a high-frequency double tone. This tone is sounded only once per activation of the turn signal. The red light will also illuminate and stay on if a failure of the side sensor is detected. If objects are temporarily unable to be detected during heavy rain, both the red and yellow lights will illuminate.

Special Road Situations

Certain special road situations may affect the system's ability to detect objects. These situations include the effects of curves, dips, and hills, which can provide an unexpected result.

NOTE: A warning may sound when an object is detected in front of the vehicle even though the driver intends to turn away or stop before reaching the object.

- When an object is detected in a very sharp right- or left-hand turn, the audible alarm will not sound.
- When approaching a curve, before turning into it, alarms may sound and lights illuminate because of an object off the road, directly in line with your vehicle. This will not occur when the brakes are applied.
- Elevated obstacles such as overpasses and overhead signs may be detected when approaching a roadway descending to a lower elevation.
- Vehicles cannot be detected on the other side of a hill. An alarm will not sound until the object is within the antenna assembly field of view.
- On approaching a steep hill, objects above the beam cannot be detected. Generally, the beam hitting the road surface does not cause an alarm.
- The side sensor only detects objects within its field of view, next to the tractor. A vehicle farther back, behind the field of view, will not be detected.
- The side sensor range is set to detect average sized vehicles, 2 to 10 feet (0.5 to 3 meters) away, in the adjacent lane.
- The radar beam of the CWS will detect near range cut-ins of approximately 30 feet (9 meters) or less, depending on the angle of entrance into the lane in front of your vehicle.

⚠ WARNING

Heavy rain or water spray at the side sensor may cause both the yellow and red lights on the side sensor display to illuminate at the same time. Under these conditions the system is temporarily unable to provide adequate warnings.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

NOTE: A continuous fixed object on the right side of the vehicle such as a guard rail, wall, tunnel, or bridge may cause the side sensor alert light to stay on.

In Case of Accident

The accident reconstruction capability provides two segments of system data, one of which can be stored in system memory. Push and hold the DDU range knob for about 5 seconds to store the first segment. Within 6 seconds, the green SC indicator light will blink rapidly 8 times, confirming that the data has been saved. If the range knob is pushed again, a fail tone will sound. After the first segment is saved, the second segment runs continuously, but only contains the last 10 minutes (approximately) of system data.

NOTE: Once the first memory segment is frozen, the other can't be frozen. Only by disconnecting the main CPU connector can the second memory segment be preserved. You must return the CPU to Eaton VORAD for downloading and interpretation of accident reconstruction data.

Maintenance and Diagnostics

1. Keep the antenna assembly and side sensor(s) free of a buildup of mud, dirt, ice, or other debris that might reduce the system's range.

2. The system tests itself continuously and evaluates the results every 15 seconds. If a problem is detected with the front radar system, the red FAIL light on the DDU illuminates continuously as long as the failure is active. The corresponding fault code is stored in the CPU's memory.
3. Both active and inactive fault codes can be indicated by the DDU when the system is placed in failure display mode. Inactive faults are those that have occurred and have cleared. Active faults are still present. Fault codes provide the driver the ability to record the system faults during a trip and to notify his maintenance department or Eaton VORAD. See "Failure Display Mode/Fault Codes" below. In this mode, specific fault codes are indicated by the pattern of blinks of the driver display unit red FAIL light.
4. Each fault code is a 2-digit number, as shown in **Table 2.2**. The red FAIL light blinks the same number of times as the first digit, a pause of approximately 3/4 of a second follows, then the light blinks the same number of times as the second digit.
5. Additional fault codes are blinked out at intervals of approximately eight seconds. After all the fault codes have been displayed, a code 41 will be flashed.

Failure Display Mode/Fault Codes

1. Press and hold the DDU volume control and power ON/OFF knob. Continue pressing the knob until the FAIL light begins to blink in approximately five seconds. If so configured, the system will turn off if you release the knob before five seconds. After five seconds, the DDU FAIL light begins to blink out the failure flash codes. A code 41 will be displayed either if no faults are found or when all fault codes have been displayed.
2. Position the DDU range knob to the left to blink active fault codes and to the right to blink inactive codes.
3. Fault codes can only be reviewed, tested, and cleared by using a Pro-Link® 9000 diagnostic tool.

Collision Warning System (CWS), Eaton VORAD EVT–300 (with ICU-Integrated display)

The Eaton VORAD EVT–300 is a computerized collision warning system (CWS) that uses front-mounted and side-mounted radar to continuously monitor vehicles ahead and alongside your vehicle.

The system warns of potentially dangerous situations by means of visual and audible alerts. The system performs in fog, rain, snow, dust, smoke, and darkness. To be detected, objects must be within the radar beam field of view and provide a surface area that can reflect back to the radar beam.

The front-looking antenna assembly transmits radar signals to, and receives them back from, vehicles and objects ahead. This allows the determination of the distance to, relative speed of, and angle to the target of vehicles and objects ahead. The system uses this information to warn the driver of potentially dangerous situations. Vehicles with SmartCruise also use this system to maintain consistent headway.

A side sensor(s), mounted on the side of the vehicle, also transmits and receives radar signals for a distance of 2 to 10 feet (0.5 to 3 meters), alongside your vehicle. The side sensor can detect vehicles and objects, moving and stationary, adjacent to your vehicle.

⚠ WARNING

The Eaton VORAD EVT–300 Collision Warning System (CWS) is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied on to operate a vehicle. Use the system in conjunction with rearview mirrors and other instrumentation to safely operate the vehicle. Operate this vehicle, equipped with the EVT–300 Collision Warning System, in the same safe manner as if the EVT–300 Collision Warning System were not present.

The EVT–300 Collision Warning System is not a substitute for safe, normal driving procedures, nor will it compensate for any driver impairment, such as drugs, alcohol, or fatigue.

The EVT–300 Collision Warning System may provide little or no warning of hazards such as pedestrians, animals, oncoming vehicles, or cross traffic.

On vehicles with SmartCruise, the vehicle will not deactivate cruise control for stationary targets, such as a car stopped in your traveling lane.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

Dash Switches

The following dash switches (**Fig. 2.60**) are used to control the collision warning system and SmartCruise.

- **Headway Alert (HDWY ALERT)**: This switch turns on the collision warning system. On most systems, the collision warning system will turn on automatically when the ignition is turned on. The switch is backlit by a green light that indicates the system is on.

  If the system is equipped with SmartCruise, the switch is not installed.

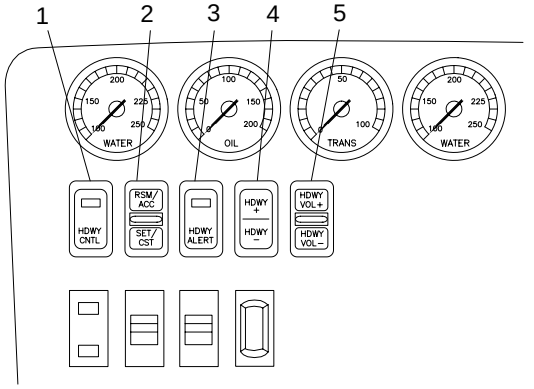
- **Headway Control (HDWY CNTL)**: This switch is installed on vehicles with SmartCruise. When this switch is pressed the light comes on to indicate that the vehicle is in SmartCruise mode. It has the same function as the SPD CNTL switch, which is installed on vehicles without SmartCruise. The switch is backlit by a green light when the Headway Control is on.

- **Resume/Accelerate - Set/Coast (RSM/ACC - SET/CST)**: This switch works the same as it does on conventional cruise control. On vehicles with SmartCruise, the speed will change, if necessary, to maintain the set headway.

- **Headway Volume (HDWY VOL+/-)**: This switch adjusts the volume of the headway alerts and other audible alerts from the CWS. The speaker volume resets to maximum volume when the system turned off and back on again, or the ignition is turned off and back on.

- **Headway Adjustment Switch (HDWY+/ HDWY-)**: This switch will adjust the headway for alerts. When the system power is reset, the headway will default back to the maximum distance.

  For vehicles with SmartCruise, the headway adjustment will determine the headway the vehicle will maintain from other moving vehicles in the same traveling lane of your vehicle. Cruise control must be set for the headway to adjust.



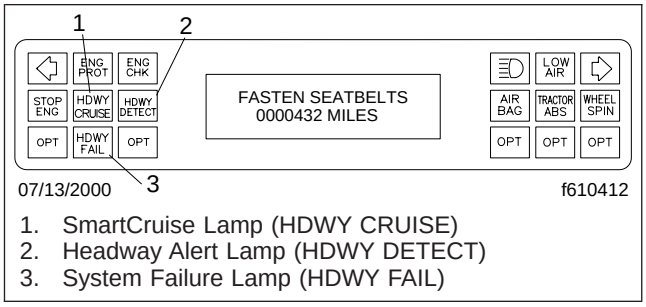
1. Headway Control Switch
2. Resume/Accelerate - Set/Coast Switch
3. Headway Alert Switch (on vehicles without Smart Cruise)
4. Headway Adjustment Switch
5. Headway Volume Switch

Fig. 2.60, Dash Switches for Collision Warning System and SmartCruise

Headway Alerts

The ICU displays indicator lights (**Fig. 2.61**) and messages that advise of multiple warning levels, system power, or system failure.

See **Table 2.3** for a complete description of the warning messages this system displays with the integrated ICU.



1. SmartCruise Lamp (HDWY CRUISE)
2. Headway Alert Lamp (HDWY DETECT)
3. System Failure Lamp (HDWY FAIL)

Fig. 2.61, ICU Indicator Lights

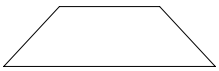
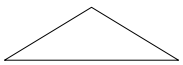
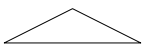
ICU Display Messages	
ICU Message	**Description**
Speed Set: 55 mph (88.5 km/h) Headway Set: 3.0s	The Speed Set and Headway readings will display when the vehicle speed drops 5 mph (8 km/h) below the set speed. The vehicle will automatically accelerate to the set speed when the headway is clear, up to the Headway Set distance.
WARNING HEADWAY FAILURE	CWS has failed. HDWY FAIL lamp will also illuminate.
WARNING CRUISE OFF	Vehicle speed is below 30 mph (48 km/h), minimum cruise speed. An audible tone will also be heard. The cruise is off.
HEADWAY RANGE – + f601895	Displays current headway setting (maximum setting displayed).
HEADWAY ALERT VOLUME – + f601896	Displays current audible tone volume (maximum volume shown).
HEADWAY EVENT DATA WAS SAVED	Accident reconstruction segment was saved.
HDWY EVENT DATA NOT SAVED, MEMORY FULL	Second accident reconstruction segment was not saved. Only one accident reconstruction segment may be saved.
OBJECT AHEAD  f601891	Displayed if an object is detected and has a headway 0.5 to 1 second. Also displayed if a very slow or stationary target is detected in the vehicle headway.
OBJECT AHEAD  f601892	Displayed if an object is detected and has a headway of more than 1 second and up to 2 seconds.
OBJECT AHEAD  f601893	Displayed if an object is detected and has a headway of more than 2 seconds and up to 3 seconds.
APPROACHING OBJECT f601894	Displayed if an object is within 15 ft (4.5 m) and the vehicle is traveling less than 5 mph (8 km/h)

Table 2.3, ICU Display Messages

The speaker provides audible alert tones to warn of closing on an object ahead and, when equipped with a side sensor, of objects alongside when the turn signal is activated in preparation for a lane change. Additional tones indicate speaker volume, system failure, and data extraction pass or fail.

The "object ahead" alerts given by the system are based on headway to the vehicle ahead, that is the time required by the host vehicle to travel ahead and reach the vehicle ahead. A simple way to figure the headway is to look when the vehicle ahead drives by a certain object, like a traffic sign, and then start counting the time required to reach the same sign. If the count reaches 3, then the headway is a 3-second headway. A more precise method of determining the headway would be to use a stopwatch rather than counting.

For example, If the headway is 3 seconds and the vehicle speed is 55 mph (88.5 km/h), then the distance to the vehicle ahead is 242 ft (74 m). If the vehicle speed is reduced to 40 mph (64 km/h), the distance is 176 ft (53.5 m) for a 3-second headway.

Audible and visual headway alerts are as follows:

- When a moving object is detected in the travel lane and is less than 350 ft (107 m) from the front of the vehicle, the HDWY DETECT light will illuminate on the ICU. No warning tone will sound.
- When a moving object is detected in the travel lane and it has a headway between one and two seconds, the HDWY DETECT light will illuminate and a message will appear on the ICU. A warning tone will sound.
- When a moving object is detected in the travel lane and it has a headway between 1/2 second and 1 second, the HDWY DETECT light will illuminate and a message will appear on the ICU. Warning tones will sound also.

  If the headway is increasing, no tone will sound. If the headway is decreasing, double tones will sound. Within a 1/2-second or less following interval, opening or closing, the tones will repeat twice per second.
- If a stationary vehicle or object, or an object moving at least 20 percent slower than your vehicle is detected within 220 feet (67 meters) and within 3 seconds, the HDWY DETECT lamp will illuminate, a message will be displayed, and double tones will sound. This warning overrides all others and is not affected by the headway setting.
- If your vehicle is traveling less than 5 mph (8 km/h) and an object is detected less than 15 ft (4.5 m) in front of your vehicle and the closing rate is less than 2 mph (3 km/h) but more than 1/2 mph (1 km/h), the HDWY DETECT lamp will illuminate, a message will be displayed, and a low-frequency double tone will sound.

NOTE: All warnings apply only to objects within the maximum headway range and in your lane. Proximity alert tones and vehicle-closing 1- to 2-second following interval tones are configured items. All tones, except the 1/2-second alert, are disabled in sharp turns or when the brakes are applied. If the configuration permits, the 3-second alert level may be adjusted with the headway adjustment switch (HDWY +/HDWY -) on the dash. A single low-frequency tone sounds when a system failure is detected. A medium-frequency tone sounds when the volume control level is changed. Successful downloading of Vehicle Information Management System (VIMS) data will cause a double tone to sound. Unsuccessful downloading will cause a low-frequency tone to sound.

Driver Identification

The EVT is capable of selecting two driver IDs. This identification can be set on the ICU.

If the vehicle is programmed for multiple drivers, follow the steps in **Fig. 2.62** to select identification of a driver.

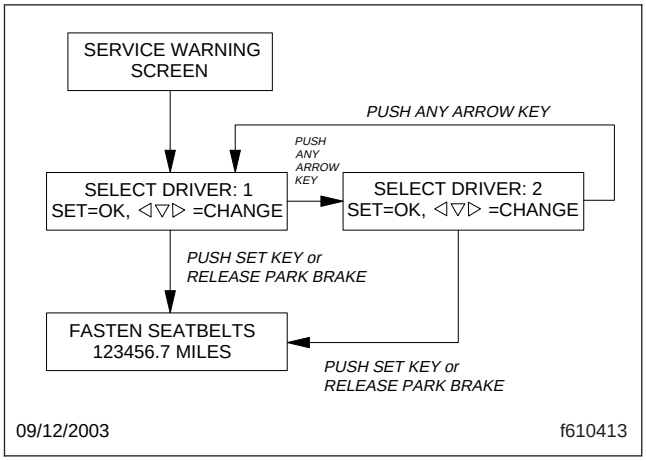


Fig. 2.62, Driver Identification Setup Sequence

SmartCruise–Adaptive Cruise Control

WARNING

The Eaton VORAD EVT–300 Collision Warning System (CWS) with SmartCruise is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied on to operate a vehicle. Use the system in conjunction with rearview mirrors and other instrumentation to safely operate the vehicle. This system will not warn of many possible hazards. It will not adjust the vehicle speed for many

possible hazards. Do not assume it is "all clear" if no alert lights are illuminated and the SmartCruise does not adjust vehicle speed.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

On vehicles with SmartCruise, the vehicle will not deactivate cruise control for stationary targets, such as a car stopped in your traveling lane.

SmartCruise is an Adaptive Cruise Control (ACC) system that uses the EVT-300 hardware and SmartCruise software to maintain the vehicle's headway by interacting with the engine and requesting that the engine either de-fuel, or de-fuel and apply the engine brakes. Since SmartCruise does not apply the service brakes or steer the vehicle, the driver needs to be in control of the vehicle at all times. Also, because of the limitations of the EVT-300 system in distinguishing real targets from false targets, when these targets are stationary and present in or near the vehicle's path (road signs in a curve or near the lane of travel, overpasses, parked vehicles on the side of the road, center dividers, retaining walls, etc.), SmartCruise ignores stationary targets when maintaining the headway. The EVT-300 Collision Warning System (CWS) alerts the driver of a target in the vehicle's path.

SmartCruise works in conjunction with the engine's cruise control functions. All of the cruise control functions operate as usual when no targets are present in front of the vehicle.

When a valid target is present and SmartCruise determines that the headway cannot be maintained it will request the engine to de-fuel, or to de-fuel and apply the engine brake. Once the correct headway has been achieved, then SmartCruise will maintain the headway. When the target vehicle accelerates beyond the vehicle set speed, SmartCruise will accelerate up to the set speed and will allow the engine to continue with the normal cruise control functions.

The driver may override the system at any time, and the system will relinquish control anytime the clutch or service brake pedals have been pressed or the fuel pedal is pressed to accelerate the vehicle.

If the vehicle speed drops below 30 mph (48 km/h) (minimum cruise set speed), the engine will change from cruise control to throttle control. The message, "WARNING CRUISE OFF" will display in the ICU.

The message will not display if the brake, clutch, or panel switches were used to deactivate cruise control.

IMPORTANT: If SmartCruise is not functioning (due to a failure), conventional cruise control can be used instead. To enable conventional cruise control, toggle the headway control (HDWY CNTL) switch twice within 10 seconds. Toggling of the switch twice only activates conventional cruise control after SmartCruise has failed.

Accident Reconstruction

The EVT-300 system has a continuously operating memory segment that records target and vehicle data for the purpose of reconstructing an accident. The memory will record as much data as possible. When the memory is full, the earliest information is recorded over.

To activate the accident reconstruction and freeze the most recent action in memory, hold the volume adjustment switch (HDWY VOL +/-) and headway adjustment switch (HDWY +/-) up simultaneously for five seconds. The ICU will confirm that the data was saved with an audible tone and the message, "HEADWAY EVENT DATA WAS SAVED."

The data stored will be cleared by the system after 30 days.

In the event that the first segment is frozen, the EVT will continue to record current data in a second segment as long as there is power to the system.

If the first segment of data has already been frozen and the user attempts to freeze another segment, the EVT will not allow the user to freeze the segment. Instead, an audible tone will be heard and the ICU will display the message, "HDWY EVENT DATA NOT SAVED, MEMORY FULL."

Side Sensor Display

The ambient light sensor senses lighting conditions and automatically adjusts the intensity of indicator and alert lights.

The yellow indicator light illuminates continuously when no vehicle is detected by the side sensor(s).

If the side sensor detects an object, the red alert light will illuminate and, if the right turn signal is activated, the speaker will sound a high-frequency double tone.

This tone is sounded only once per activation of the turn signal. The red light will also illuminate, and stay on, if a failure of the side sensor is detected. If objects are temporarily unable to be detected during **very heavy** rain storms, both the red and yellow lights will illuminate

Special Road Situations

Certain special road situations may affect the system's ability to detect objects. These situations include the effects of curves, dips, and hills, and these can provide an unexpected result.

NOTE: A warning may sound when an object is detected in front of the vehicle even though the driver intends to turn away or stop before reaching the object.

- When an object is detected in a very sharp right- or left-hand turn, the audible alarm will not sound.
- When approaching a curve, before turning into it, alarms may sound and lights illuminate because of an object off the road, directly in line with your vehicle. This will not occur when the brakes are applied.
- Elevated obstacles such as overpasses and overhead signs may be detected when approaching a roadway descending to a lower elevation.
- Vehicles cannot be detected on the other side of a hill. An alarm will not sound until the object is within the antenna assembly's field of view.
- On approaching a steep hill, objects above the beam cannot be detected. Generally, the beam hitting the road surface does not cause an alarm.
- The side sensor only detects objects within its field of view, next to the tractor. A vehicle farther back, behind the field of view, will not be detected.
- The side sensor range is set to detect average sized vehicles, 2 to 10 feet (0.5 to 3 meters) away, in the adjacent lane.
- The radar beam of the CWS will detect near range cut-ins of approximately 30 feet (9 meters) or less, depending on the angle of entrance into the lane in front of your vehicle.

⚠ WARNING

Heavy rain or water spray at the side sensor may cause the red light on the side sensor display to illuminate. Under these conditions the system is temporarily unable to provide adequate warnings.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

NOTE: A continuous fixed object on the right side of the vehicle such as a guard rail, wall, tunnel, or bridge may cause the side sensor alert light to stay on.

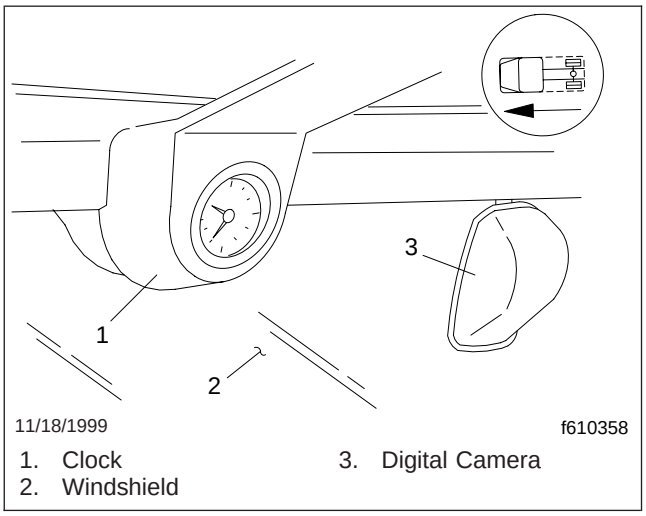
Maintenance and Diagnostics

1. Keep the antenna assembly and side sensor(s) free of a buildup of mud, dirt, ice, or other debris that might reduce the system's range.
2. The system tests itself continuously and evaluates the results every 15 seconds. If a problem is detected with the front radar system, the HDWY FAIL light on the ICU illuminates continuously as long as the failure is active. The corresponding fault message is displayed on the ICU.
3. Both active and inactive faults can be indicated by the ICU when the system is placed in failure display mode. Inactive faults are those that have occurred and have cleared. Active faults are still present. Faults provide the driver the ability to record the system faults during a trip and to notify his maintenance department or Eaton VORAD. In this mode, specific fault messages are displayed on the ICU.
4. Additional failure messages display at intervals of approximately 8 seconds.

Lane Guidance™ System

The Lane Guidance lane departure warning system monitors the vehicle's position within the roadway lane markings and sounds a warning in the cab when the vehicle is about to stray outside its lane, provided the turn signal is not on and the vehicle is traveling at least 40 mph (64 km/h). The system includes a digital camera mounted high near the center of the windshield inside the cab (**Fig. 2.63**), a central processing unit in the overhead console, and a stereo speaker above and behind each door that emits

a sound similar to a rumble strip. The sound is made on the side of the vehicle it's straying toward, prompting the driver to respond and steer away from the sound and back into the center of the correct lane.



1. Clock
2. Windshield
3. Digital Camera

Fig. 2.63, Lane Departure Warning System Camera

⚠ WARNING

The lane departure warning system is intended only as an aid for a conscientious and alert driver. The system may not indicate lane departures under certain conditions. Read carefully the information in this manual to understand the circumstances under which this system may not provide adequate lane departure warnings. Do not rely solely on the system to safely operate the vehicle. The system does not warn of all possible hazards. For example, the system cannot prevent an accident if the driver is impaired or not driving safely.

The lane departure warning system is not a substitute for safe driving procedures.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

IMPORTANT: It is still the responsibility of the driver to change driving styles depending on existing traffic and road conditions.

Starting the vehicle activates the system. On start-up the system performs a self-test, then sounds two chirps through the speakers to indicate the system is ready. The rocker switch on the B instrument panel turns the system on and off. Once the vehicle is started and the system is ready, the ON light at the bottom of the switch illuminates. Pushing the top of the rocker switch turns the system off; pushing the switch again turns the system on. The top portion of the switch reads LANE ALERT, and is backlit with the dash lights on.

The LANE SRCHNG amber warning light illuminates to indicate the system is not fully functional. When the warning light is on, the system audible alert may not indicate a lane departure. Conditions that can cause the warning light to come on include:

- The system is unable to detect lane markings.
- Vehicle speed is less than 40 mph (64 km/h).
- Lane width is greater than 13 feet (4 m).
- A dirty windshield or a similar problem is obscuring the camera.
- A system problem is detected.

While the system is capable of detecting a number of different types of lane markers, its performance may be compromised or degraded by certain conditions, including the following:

- Weather conditions such as snow, heavy rain, ice, or standing water.
- Damaged, worn, or faded lane markings.
- Broken pavement, dirt, sand, salt, gravel, or skid marks.
- Poor lighting, such as heavy glare or an inoperable headlight.
- A cracked, dirty, or streaked windshield.

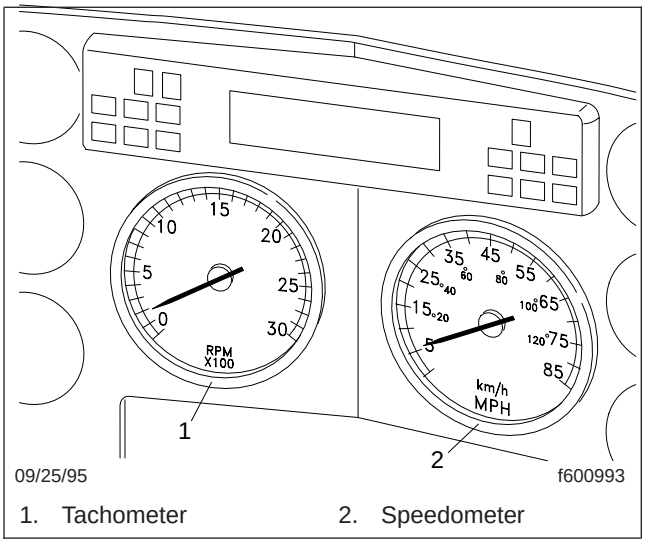
The lane guidance system is not meant for use in city traffic or in heavy highway traffic. System alerts are automatically disabled when vehicle speed drops below 40 mph (64 km/h). The system may be manually turned off with the instrument panel rocker switch if an unacceptable level of false alerts is reached.

NOTE: If the green light on the LANE ALERT rocker switch remains off despite depressing the switch, and the LANE SRCHNG amber warning light remains on, the system is not fully functional and needs service at an authorized service facility.

Instruments

Tachometer

The tachometer (**Fig. 2.64**) indicates engine speed in revolutions per minute (rpm) and serves as a guide for shifting the transmission and keeping the engine in the appropriate rpm range. For low idle and rated rpm, see the engine identification plate. The green color band on the tachometer indicates the best fuel economy range. The yellow band indicates lower fuel economy, the orange band indicates much lower fuel economy, and the red band indicates poor fuel economy.



1. Tachometer
2. Speedometer

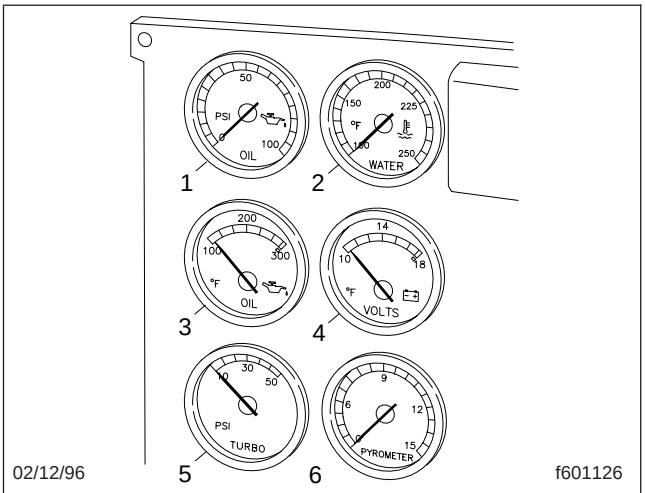
Fig. 2.64, Instrument Panel (center)

Speedometer

The speedometer (**Fig. 2.64**) registers speed in both miles per hour (mph) and kilometers per hour (km/h).

Engine Oil Pressure Gauge

The engine oil pressure gauge (**Fig. 2.65**) should read as shown in **Table 2.4**.



1. Engine Oil Pressure Gauge
2. Coolant Temperature Gauge
3. Engine Oil Temperature Gauge
4. Voltmeter
5. Turbocharger Boost Pressure Gauge
6. Pyrometer

Fig. 2.65, Instrument Panel Gauges (left side)

Oil Pressure*		
Engine Model	**At Idle Speed: psi (kPa)**	**At Rated RPM: psi (kPa)**
Caterpillar C–10	10–20 (69–138)	30–45 (207–310)
Caterpillar C–12	10–20 (69–138)	30–45 (207–310)
Caterpillar 3406E	15 (100) min.	40 (275) min.
Cummins M11	10 (69) min.	35–45 (241–310)
Cummins N14†	10 (69) min.	35–45 (241–310)
Cummins ISX	15 (103) min.	35 (241) min.
Detroit Diesel S60	12 (83)	50 (345) min.
MBE-4000	7 (50)	36 (250) min.
DD13/DD15	14 (97)	55 (350) min.

* Oil pressures are given with the engine at operating temperature. With the engine cold, oil pressure may be higher.

† Individual engines may vary from the listed pressures; observe and record pressures when the engine is new to create a guide for checking engine condition.

Table 2.4, Oil Pressure

NOTICE

A sudden decrease or absence of oil pressure may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine

until the cause has been determined and corrected.

Coolant Temperature Gauge

During normal engine operation, the coolant temperature gauge (**Fig. 2.65**) should read 175 to 195°F (79 to 91°C). If the temperature remains below 160°F (71°C) or exceeds the maximum temperature shown in **Table 2.5**, inspect the cooling system to determine the cause. See **Group 20** of the *Century Class Trucks Workshop Manual* for troubleshooting and repair procedures.

Maximum Coolant Temperature	
Engine Model	**°F (°C)**
Caterpillar	215 (101)
Cummins	225 (107)
Mercedes-Benz	221 (105)
Detroit Diesel	215 (101)

Table 2.5, Maximum Coolant Temperature

Engine Oil Temperature Gauge

During normal operation, the engine oil temperature gauge should read from 200 to 260°F (93 to 126°C). Under heavy loads, such as when climbing steep grades, temperatures that exceed the normal oil temperature range for a short period are not unusual.

NOTICE

A sudden increase in oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

Voltmeter

The voltmeter (**Fig. 2.65**) indicates the vehicle charging system voltage when the engine is running and the battery voltage when the engine is stopped. By monitoring the voltmeter, the driver can be aware of potential charging system problems and have them fixed before the batteries discharge enough to create starting difficulties.

The voltmeter will normally show approximately 13.7 to 14.1 volts when the engine is running. The voltage of a fully charged battery is 12.7 to 12.8 volts when the engine is stopped. A completely discharged battery will produce only about 12.0 volts. The voltmeter will indicate lower voltage as the vehicle is being started or when electrical devices in the vehicle are being used.

If the voltmeter shows an undercharged or overcharged condition for an extended period, have the charging system and batteries checked at a repair facility.

On a vehicle equipped with a battery isolator system, the voltmeter measures the average voltage of all the batteries when the engine is running. When the engine is stopped, the voltmeter shows only the gel cell battery voltage and does not indicate the voltage of the engine-starting batteries.

NOTICE

Gel cell batteries can be damaged if the battery voltage is allowed to drop below 12.0 volts or if the charging voltage is more than 14.1 volts. Start the engine to recharge the gel cell before the battery becomes fully discharged. If an external charger is needed, disconnect the gel cell battery and use only an external battery charger that has been approved for gel cell batteries.

Turbocharger Boost Pressure Gauge

A turbocharger boost pressure gauge (**Fig. 2.65**) measures the pressure in the intake manifold, in excess of atmospheric pressure, being created by the turbocharger.

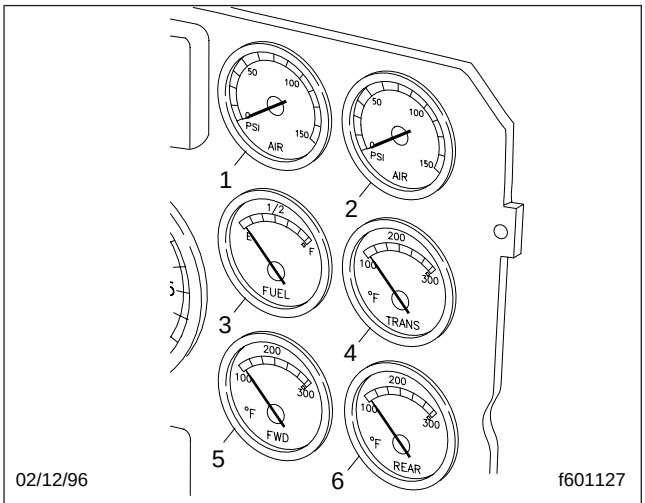
Pyrometer

A pyrometer registers the exhaust temperature near the turbocharger. Normal exhaust temperatures are 700 to 1100°F (370 to 595°C).

Variations in engine load can cause exhaust temperatures to rise as high as 1100°F (600°C). If the pyrometer reading shows that exhaust temperature exceeds normal, reduce fuel to the engine until the exhaust temperature is reduced. Shift to a lower gear if the engine is overloaded.

Primary and Secondary Air Pressure Gauges

Air pressure gauges (**Fig. 2.66**) register the pressure in the primary and secondary air systems. Normal pressure, with the engine running, is 100 to 120 psi (689 to 827 kPa) in both systems. A low-air-pressure warning light and buzzer, connected to both the primary and secondary systems, activate when air pressure in either system drops below a minimum pressure of 64 to 76 psi (441 to 524 kPa). When the engine is started, the warning light and buzzer remain on until air pressure in both systems exceeds minimum pressure.



1. Primary Air Pressure Gauge
2. Secondary Air Pressure Gauge
3. Fuel Gauge
4. Transmission Oil Temperature Gauge
5. Forward Axle Oil Temperature Gauge
6. Rear Axle Oil Temperature Gauge

Fig. 2.66, Instrument Panel Gauges (right side)

Fuel Gauge

The fuel gauge (**Fig. 2.66**) indicates the level of fuel in the fuel tank(s). If equipped with a second fuel gauge, each fuel tank level is indicated on a separate gauge.

Transmission Oil Temperature Gauge

During normal operation, the transmission oil temperature gauge (**Fig. 2.66**) reading should not exceed 250°F (121°C) for Fuller transmissions.

NOTICE

A sudden increase in oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

Forward and Rear Axle Oil Temperature Gauges

During normal operation, forward and rear axle oil temperature gauges (**Fig. 2.66**) should read between—

- 160 and 220°F (71 and 104°C) for Meritor™ drive axles;
- 180 and 200°F (82 and 93°C) for Eaton drive axles.

Under heavy loads, such as when climbing steep grades, temperatures up to a maximum of 250°F (121°C) are not unusual.

NOTICE

A sudden increase in oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

Application Air Pressure Gauge

An application air pressure gauge registers the air pressure being used to apply the brakes and should be used for reference only. The gauge will not register air pressure until the foot brake pedal is depressed or the trailer hand brake is applied.

Intake-Air Restriction Gauge

An intake-air restriction gauge measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. Vacuum is measured in inH_2O (inches of water). When the vacuum reading in normal operation equals the applicable level shown under "Service" in **Table 2.6**, the air cleaner needs to be serviced.

NOTE: Rain or snow can wet the filter and cause a temporarily higher than normal reading.

Intake-Air Restriction Indicator

An intake-air restriction indicator (**Fig. 2.67**) measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the yellow signal stays locked at or above the values shown in **Table 2.6** after the engine is shut down, the air cleaner needs to be serviced. The indicator then needs to be reset by pressing the yellow button.

Intake-Air Restriction		
Engine Type*	**Initial: inH_2O**	**Service: inH_2O**
Cummins	12	25
Detroit Diesel	12	20
Caterpillar	15	25
Mercedes-Benz	10	22

* Turbocharged engines must be checked at full load and governed engine speed.

Table 2.6, Intake-Air Restriction

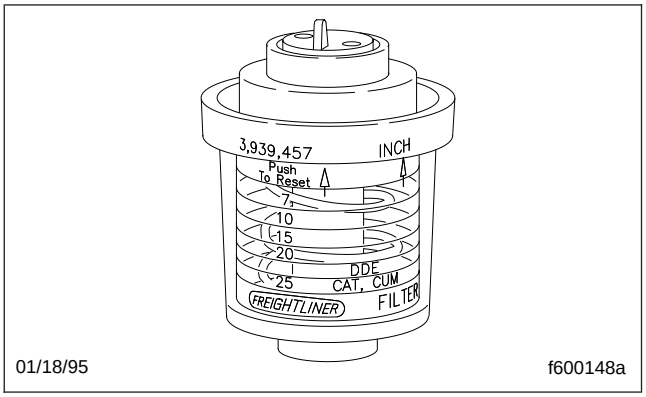


Fig. 2.67, Intake-Air Restriction Indicator

NOTE: Rain or snow can wet the filter and cause a temporarily higher than normal reading.

Ammeter

An ammeter measures current flowing to and from the battery. When the batteries are charging, the meter needle moves to the plus side of the gauge; when the batteries are being discharged, the needle moves to the minus side. A consistent negative reading when the engine is running indicates a possible problem with the charging system.

Borg Indak Analog Clock

The analog clock features electronic setting. Do not pull the set knob. The time can be set either forward (turn knob to the right) or backward (turn the knob to the left). A slight turn of the knob either right or left will change the setting of the clock one minute at a time. Holding the knob to either the right or the left will allow accelerated sweeping of the hands for setting the hour.

Pana-Pacific Digital Clock

A Pana-Pacific clock has black characters on a constantly backlighted green display, with a brightness that automatically adjusts for day or night. The clock has a 24-hour alarm, with a three-minute snooze feature.

1. To set the time of day:

   1.1 Push the Run/Set (lower) switch to the right (TIME-SET position).

   NOTE: When the hour setting is for a time between noon and midnight, the small letters PM will appear in the lower left corner of the display; no PM indicates an A.M. setting.

   1.2 Advance the hour setting to the correct number by pushing and releasing the hour button as many times as needed. Or if the button is pressed and held in for longer than two seconds, the numbers will continue to advance until the button is released.

   1.3 Advance the minute setting by repeatedly pushing, or pushing and holding the minute button as needed.

   1.4 Push the Run/Set switch to the middle (RUN) position.

2. To set the alarm time:

   2.1 Push the Run/Set switch to the left (ALARM-SET position).

   2.2 Set the alarm time by using the same procedure that you used to set the time of day. Remember to set the hour for A.M. (no letters in the corner of the display), or P.M. as desired.

2.3 Return the Run/Set switch to the middle (RUN) position. The readout will return to the time-of-day setting.

3. To operate the alarm:

3.1 With the alarm time set, push the alarm (upper) switch to the left. An alarm "wave" symbol and the letters AL will appear in the upper left corner of the display when the alarm is on.

3.2 When the displayed time of day coincides with the alarm time, the alarm will sound. If the "snooz" button is not pushed or the alarm switch is not moved, the alarm will automatically stop sounding after one minute and will not sound again for 24 hours.

3.3 If desired, press the "snooz" button while the alarm is sounding to shut the alarm off for three minutes. The alarm symbol will flash in the display when the button is pushed and will continue to flash until the alarm switch is moved or the alarm has sounded for one minute. The snooze procedure can be done as many times as desired.

3.4 Move the alarm switch to the right when you wish to shut off or cancel the alarm; the alarm symbol will disappear.

Kysor Digital Clock

A Kysor digital clock has a constant red display, which automatically adjusts the brightness for day or night. The clock features a 24-hour alarm.

1. To set the time of day:

1.1 Depress both of the time "Set" push buttons, labelled "Fast" and "Slow"; 12:00 A.M. will appear as the readout.

NOTE: A small illuminated red dot in the upper left side of the clock (above "PM") indicates P.M.; no dot indicates A.M.

1.2 Advance to the correct time by pushing either the "Fast" or "Slow" push button.

2. To set the alarm:

2.1 Depress the alarm "Set" push button. Observe that a red lamp above the word "Alarm" illuminates.

2.2 Set the alarm time by using the same procedure that you used to set the time of day. Remember to select either A.M. (no red dot) or P.M. (red dot illuminates) when setting the alarm time.

2.3 After the desired alarm time appears, depress the alarm "Set" push button again. The readout will return to the time of day and the red lamp will go out.

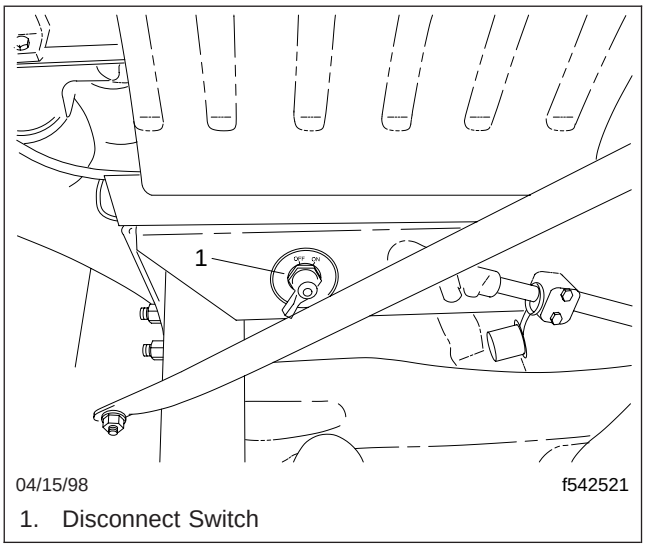
2.4 To set the alarm, depress the alarm "On" push button. Observe that a red dot on the right side of the time-of-day readout is illuminated. The alarm is now set, and when the displayed time of day coincides with the alarm time, the alarm will sound.

2.5 To cancel or shut off the alarm, depress the alarm "On" push button again. The red dot on the face of the clock will go out.

Exterior Switches

Battery Disconnect Switch

A battery disconnect switch (**Fig. 2.68**) cuts off all battery power to the vehicle. The switch is used whenever service operations require that the batteries be disconnected. It is also used whenever the vehicle is placed out of service for extended periods to prevent battery discharge.



1. Disconnect Switch

Fig. 2.68, Battery Disconnect Switch

3

Vehicle Access

Ignition and Lock Key 3.1
Cab Door Locks and Handles 3.1
Cab Access 3.1
Door Windows 3.12
Sleeper Compartment Vents 3.12
Circuit Breaker/Relay Panel 3.12
Cab-to-Sleeper Access 3.12
Sleeper Bunk Latches 3.13
Baggage Compartment Doors 3.13
Back-of-Cab Grab Handles, Steps, and Deck Plate 3.13
Battery Box Cover 3.14
Hydraulic Cab-Tilt System 3.15
Keyless Security System (optional) 3.18
Cab Amenities 3.21
Windshield Washer Reservoir 3.21
Cab Front Access Panel 3.21

Ignition and Lock Key

One key operates the ignition switch and all of the door locks.

IMPORTANT: Each key is numbered. Record the number so, if needed, a duplicate key can be made.

Cab Door Locks and Handles

To unlock the driver's door from outside the cab, insert the key in the lockset and turn it one-quarter turn clockwise (**Fig. 3.1**). Turn the key counterclockwise to the original position to remove it. Pull out on the paddle handle to open the door (**Fig. 3.1**).

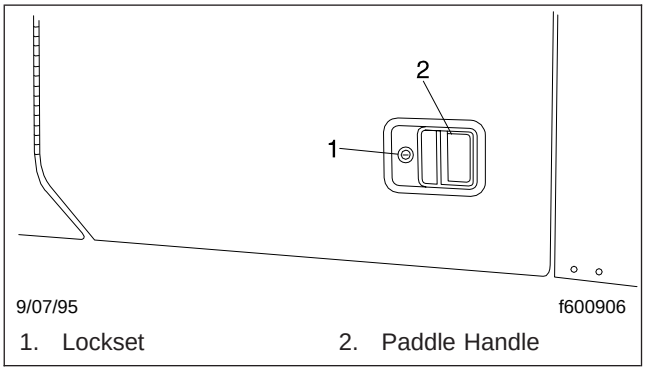


Fig. 3.1, Exterior Door Handle

To unlock the passenger's door from outside the cab, insert the key in the lockset and turn it one-quarter turn counterclockwise. Turn the key to the original position to remove it.

NOTE: The cab door locks can be operated when the doors are open.

To lock a door from outside the cab, insert the key in the lockset and turn it opposite the unlocking direction, then close the door if it is open. Or, push down the inside lock button (**Fig. 3.2**), then close the door.

To lock either door from inside the cab, push down the lock button (**Fig. 3.2**), then close the door if it is open. Pull the integral grab bar (**Fig. 3.2**) when closing the door.

To open the door from the inside, pull the door handle toward you (**Fig. 3.2**). This will unlatch the door whether or not it is locked. To unlock the door without unlatching it, pull the lock button up.

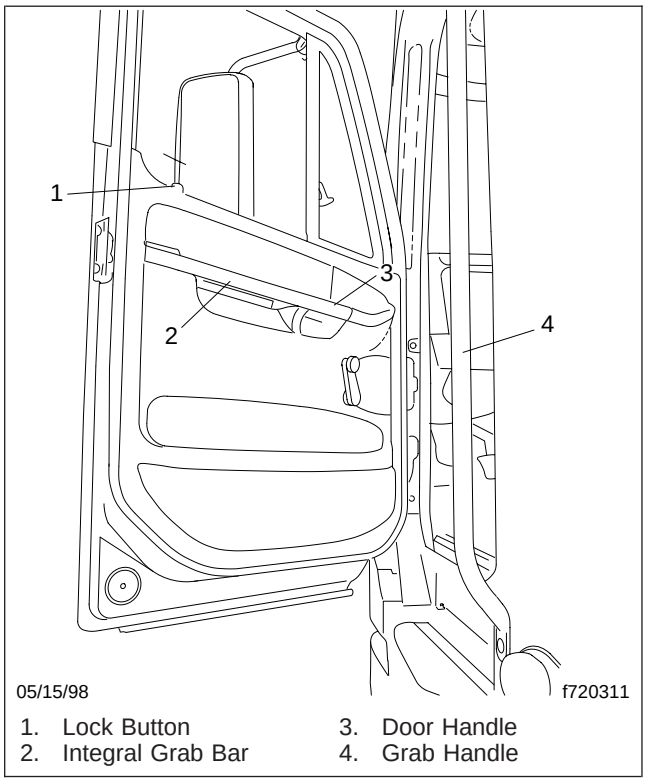


Fig. 3.2, Door Interior

Cab Access

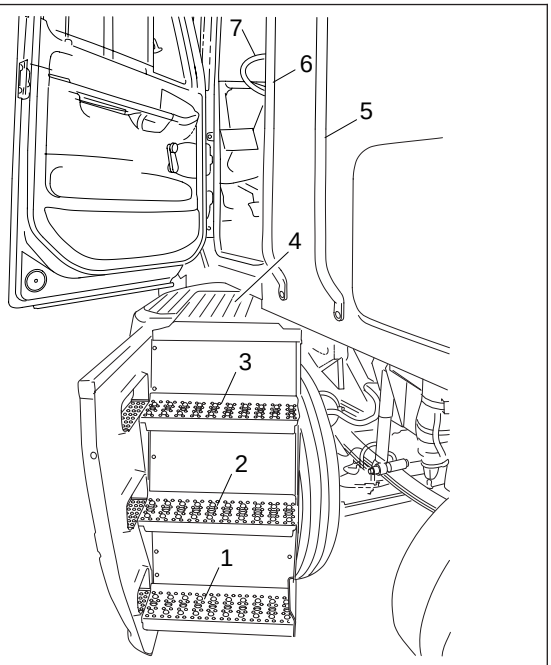
WARNING

Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when climbing onto, or down from, the back-of-cab area.

Always maintain three-point contact with the back-of-cab access supports while entering and exiting the back-of-cab area. Three-point contact means both feet and one hand, or both hands and one foot, on the grab handles, steps, and deck plates. Other areas are not meant to support back-of-cab access, and grabbing or stepping in the wrong place could lead to a fall, and personal injury.

Be careful not to get hands or feet tangled in hoses or other back-of-cab equipment. Carelessness could cause a person to trip and fall, with possible injury.

Cab Access Stairs, Optional (Fig. 3.3)



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1. Bottom Step
2. Middle Step
3. Top Step
4. Top Deck
5. Aft Grab Handle
6. Forward Grab Handle
7. Steering Wheel

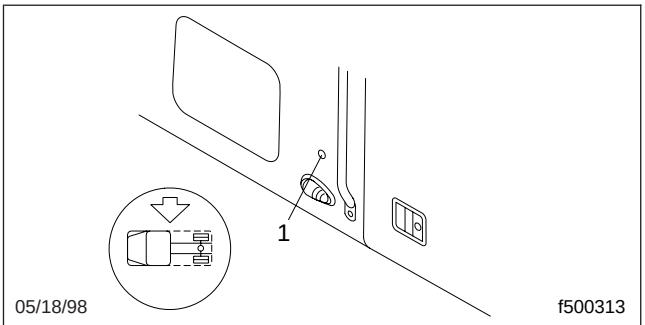
Fig. 3.3, Optional Cab Access Stairs, Driver's Side Shown

The optional cab access stairs will move into position when you open the cab door from the inside or the outside. As the stairs deploy, an alarm outside the vehicle will sound. If anything prevents deployment of the stairs (for example: if the parking brake is not set, or something is blocking the stairs, or the cab is tilted) a buzzer will sound and an indicator light will activate on the dash. If the interior buzzer and light activate, the exterior alarm will also sound.

You can open the door without activating the stairs as follows:

- If you're outside the cab, press the button on the cab side, directly above the stairs before opening the door. See **Fig. 3.4**.
- If you're inside the cab, press the dash rocker switch labeled RH STEP or LH STEP while opening the cab door.

NOTE: You must press the disable button each time you don't want the stairs to deploy. Pressing the button will disable the stairs for one cycle of opening and closing the door. The next time you open the door the stairs will deploy unless you've pressed the disable button again.



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1. Stairs Disable Button

Fig. 3.4, Stairs Disable Button, Cab Right Side Shown

The cab stairs will not operate in any of the following conditions:

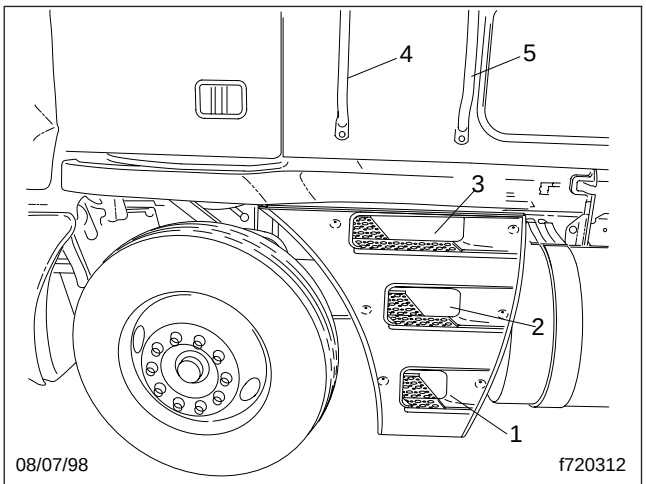
- The stairs will not deploy if the parking brake is not set.
- The stairs will not deploy if the vehicle is in motion. The stairs will automatically stow if the vehicle begins to move.
- The stairs will not stow if there is any weight on them.
- The stairs will not deploy if the cab is tilted.
- The stairs will stop moving out if they hit anything.
- The stairs will stop moving out if you press the outside or inside buttons described above.

⚠ WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two

hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

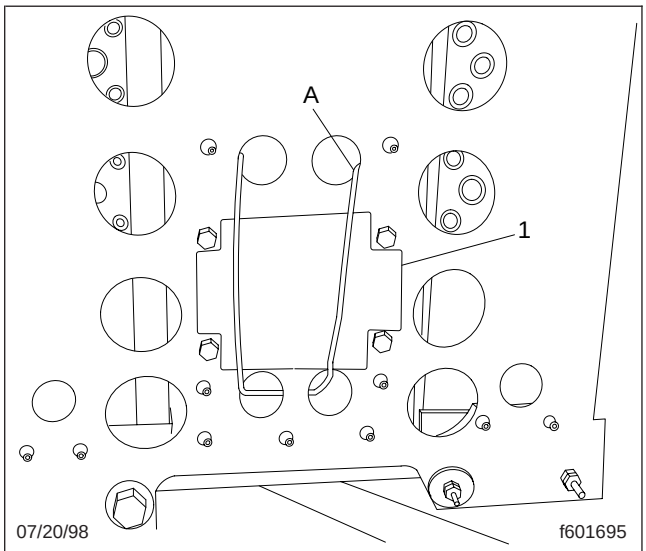


1. Bottom Step
2. Middle Step
3. Top Step
4. Forward Grab Handle
5. Aft Grab Handle

Fig. 3.5, Fixed Access Steps and Grab Handles, Driver's Side

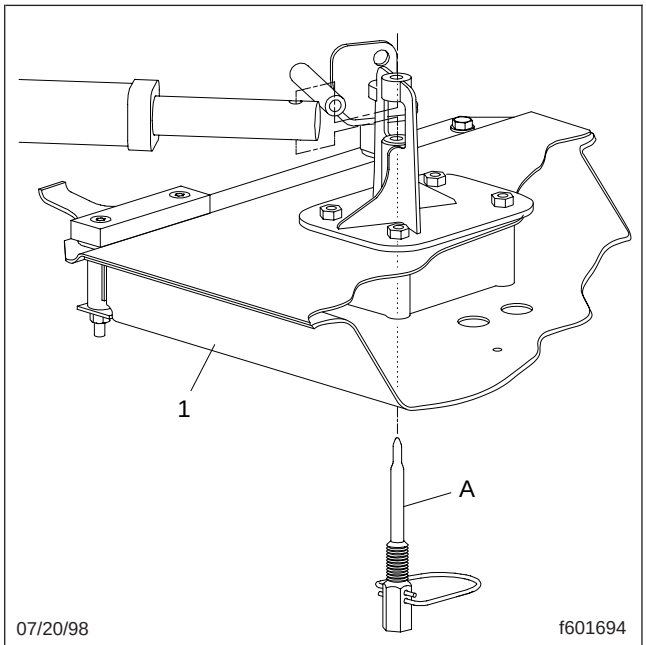
IMPORTANT: If the stairs do not stow automatically, you can stow them manually as follows:

1. Remove the plastic cover on the underside of the stairs assembly. See **Fig. 3.6**.
2. Remove the quick release pin by pulling its spring handle down and using the handle to unscrew the pin. If the pin is stuck, you can use a 7/8-inch socket to remove it. This disconnects the stairs assembly from its control arm. See **Fig. 3.7**.
3. Press the stairs into the stowed position.
4. Secure the stairs in the stowed position. See **Fig. 3.8**.
   - 4.1 Locate the L-rod mounted on the lower cab structure near where the V-block on the inboard side of the stairs mates with the U-bolt on the cab.
   - 4.2 Loosen the wheel nut around the L-rod.



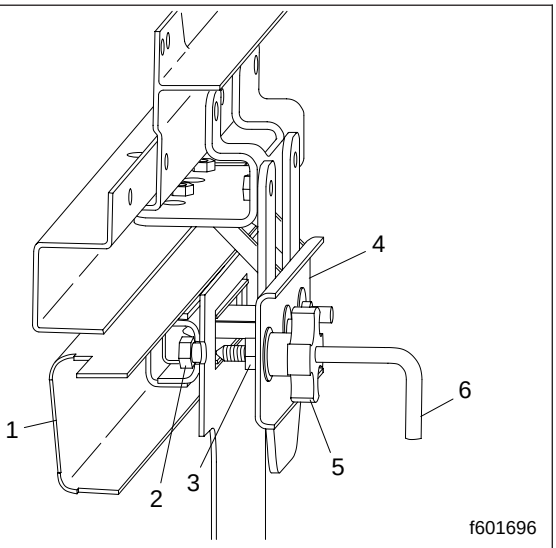
A. Remove this clip to remove the plastic cover.
1. Plastic Cover

Fig. 3.6, Cab Access Stairs, Underside Shown



A. Unscrew the release pin.
1. Cab Access Stairs, Top Deck

Fig. 3.7, Removing the Quick Release Pin



1. Cab Access Stairs Assembly
2. Nut on Stairs Assembly
3. Nut on L-Rod
4. Lower Cab Assembly
5. Wheel Nut
6. Threaded L-Rod

Fig. 3.8, Manually Securing the Access Stairs

4.3 Turn the L-rod until it extends out and engages the nut in the stairs assembly. Keep turning the L-rod until the nut on the L-rod is flush with the inboard surface of the stair assembly.

4.4 Tighten the wheel nut.

5. If you can't secure the stairs using the L-rod, use wire, tie straps or bungee cords to hold the stairs in the stowed position.

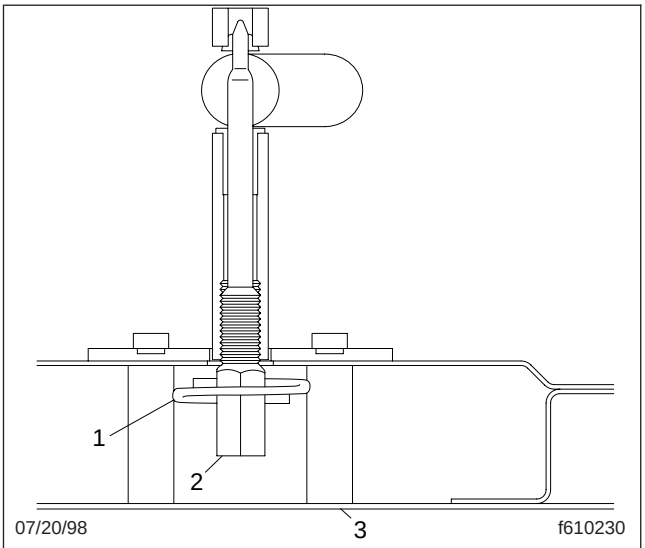
NOTE: When replacing the quick release pin, you must fold the pin's spring handle back up against the pin. This will hold the pin in place after it's installed. See **Fig. 3.9**.

Entering the Driver's Side Using the Cab Access Stairs (Fig. 3.3)

⚠ WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.



1. Pin Handle (in correct stowed position)
2. Release Pin
3. Underside of Access Stairs

Fig. 3.9, Quick Release Pin, Cab Access Stairs

1. Open the driver's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle (**Fig. 3.3**) with your right hand and grab the forward grab handle with your left hand. Reach up as far as you're comfortable.
3. Very carefully place your right foot on the bottom step and pull yourself up.
4. Place your left foot on the next step and carefully pull yourself up.

5. Place your right foot on the top step and carefully move your right hand to the forward grab handle and your left hand to the steering wheel. Hold on very tightly and maintain three-point contact with the cab at all times.
6. Then, slowly move your left foot to the deck at the top of the stairs.
7. Holding tightly to the steering wheel with your left hand, move your right hand to the steering wheel.
8. With both of your hands gripping the steering wheel tightly, step into the cab with your right foot.
9. With your right foot securely in the cab and both hands gripping the steering wheel, move your left foot into the cab.

Exiting the Driver's Side Using the Cab Access Stairs (Fig. 3.3)

⚠ WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the steering wheel tightly with both your hands, and stand on the deck at the top of the stairs facing into the cab.
2. With your right hand, grasp the forward grab handle.
3. Move your right foot very carefully to the top step.
4. Move your left hand to the forward grab handle and grip it tightly.

   At this point, both your hands should be gripping the forward grab handle.
5. Move your left foot to the next step.
6. Maintaining three-point contact with the cab at all times, very carefully move your right hand to the aft grab handle.
7. Move your right foot to the bottom step.
8. Step to the ground with your left foot.
9. Let go of the grab handles.

Entering the Passenger's Side Using the Cab Access Stairs (Fig. 3.10)

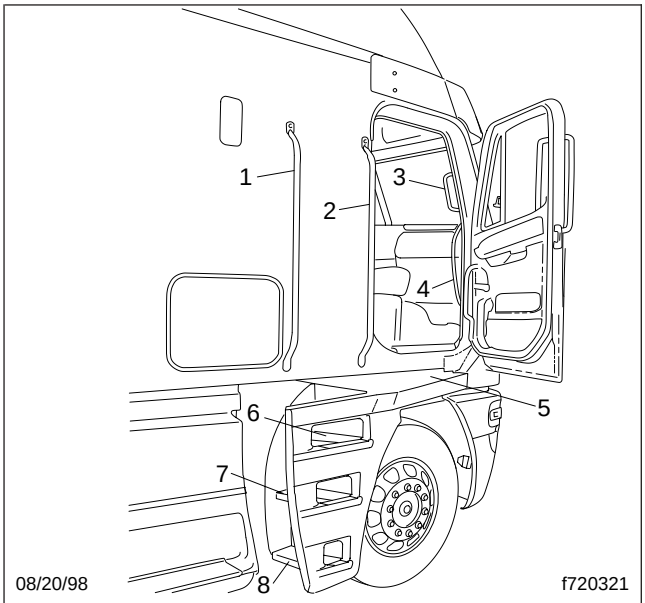
⚠ WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle with your left hand and grab the forward grab handle with your right hand. Reach up as far as you're comfortable.
3. Very carefully place your left foot on the bottom step, and pull yourself up.

4. Place your right foot on the next step, and carefully pull yourself up.
5. Place your left foot on the top step, and carefully move your left hand to the forward grab handle and your right hand to the lower inside grab handle. See **Fig. 3.10**. Hold on very tightly and maintain three-point contact with the cab at all times.



1. Aft Grab Handle
2. Forward Grab Handle
3. Upper Inside Grab Handle
4. Lower Inside Grab Handle
5. Passenger Door Threshold
6. Top Step
7. Middle Step
8. Bottom Step

Fig. 3.10, Passenger's Access Stairs and Grab Handles

6. Then, slowly move your right foot to the threshold of the door.
7. Holding tightly to the lower inside grab handle with your right hand, move your left hand to the upper inside grab handle. See **Fig. 3.10**.
8. With both of your hands gripping the inside grab handles tightly, step into the cab with your left foot.
9. With your left foot securely in the cab and both hands gripping the inside grab handles, move your right foot into the cab.

Exiting the Passenger's Side Using the Cab Access Stairs (Fig. 3.10)

WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the upper inside grab handle (**Fig. 3.10**) and stand in the threshold of the door facing into the cab.
2. With your left hand, grasp the forward grab handle.
3. Move your left foot very carefully to the top step.
4. Move your right hand to the lower inside grab handle and grip it tightly.
5. Move your right foot to the next step.
6. Maintaining three-point contact with the cab at all times, very carefully move your right hand to the forward grab handle. Then, move your left hand to the aft grab handle .
7. Move your left foot to the bottom step.
8. Step to the ground with your right foot.
9. Let go of the grab handles.

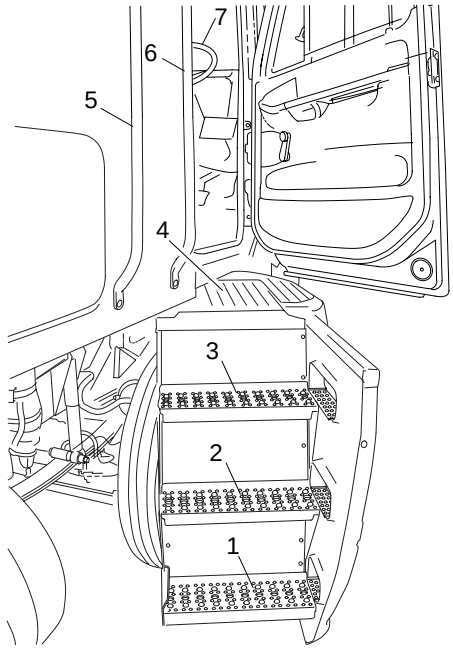
Entering the Driver's Side Using the Cab Access Stairs for Right-Hand-Drive Vehicles (Fig. 3.11)

WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

1. Open the driver's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle (Fig. 3.11) with your left hand and grab the forward grab handle with your right hand. Reach up as far as you're comfortable.
3. Very carefully place your left foot on the bottom step and pull yourself up.
4. Place your right foot on the next step and carefully pull yourself up.
5. Place your left foot on the top step, and carefully move your left hand to the forward grab handle and your right hand to the steering wheel. Hold on very tightly and maintain three-point contact with the cab at all times.
6. Then, slowly move your right foot to the deck at the top of the stairs.
7. Holding tightly to the steering wheel with your right hand, move your left hand to the steering wheel.
8. With both of your hands gripping the steering wheel tightly, step into the cab with your left foot.



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1. Bottom Step
2. Middle Step
3. Top Step
4. Top Deck
5. Aft Grab Handle
6. Forward Grab Handle
7. Steering Wheel

Fig. 3.11, Right-Hand-Drive Optional Cab Access Stairs, Driver's Side Shown

9. With your left foot securely in the cab and both hands gripping the steering wheel, move your right foot into the cab.

Exiting the Driver's Side Using the Cab Access Stairs for Right-Hand-Drive Vehicles (Fig. 3.11)

WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and

maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the steering wheel tightly with both your hands, and stand on the deck at the top of the stairs facing into the cab.
2. With your left hand, grasp the forward grab handle.
3. Move your left foot very carefully to the top step.
4. Move your right hand to the forward grab handle and grip it tightly.

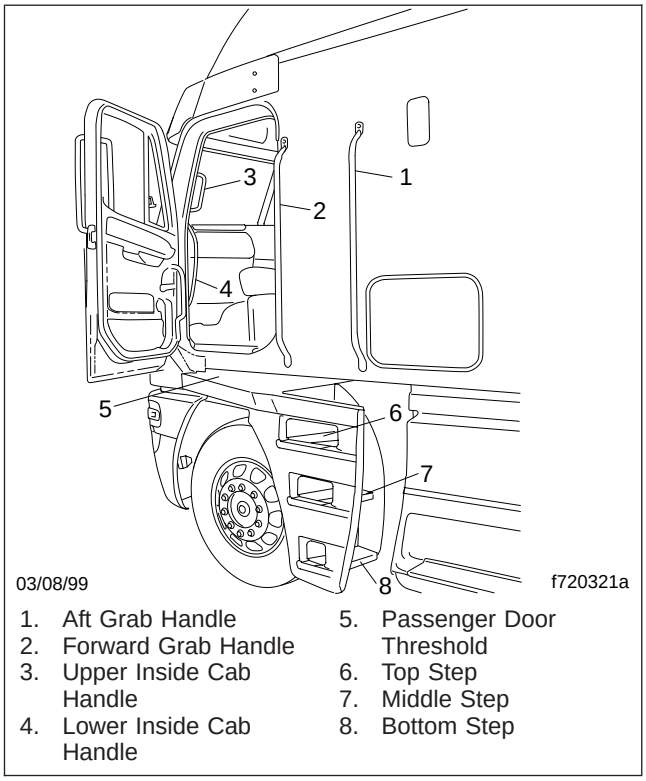
   At this point, both your hands should be gripping the forward grab handle.
5. Move your right foot to the next step.
6. Maintaining three-point contact with the cab at all times, very carefully move your left hand to the aft grab handle.
7. Move your left foot to the bottom step.
8. Step to the ground with your right foot.
9. Let go of the grab handles.

Entering the Passenger's Side Using the Cab Access Stairs for Right-Hand-Drive Vehicles (Fig. 3.12)

⚠ WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all



1. Aft Grab Handle
2. Forward Grab Handle
3. Upper Inside Cab Handle
4. Lower Inside Cab Handle
5. Passenger Door Threshold
6. Top Step
7. Middle Step
8. Bottom Step

Fig. 3.12, Right-Hand-Drive Passenger's Access Stairs and Grab Handles

times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle with your right hand and grab the forward grab handle with your left hand. Reach up as far as you're comfortable.
3. Very carefully place your right foot on the bottom step, and pull yourself up.
4. Place your left foot on the next step, and carefully pull yourself up.
5. Place your right foot on the top step, and carefully move your right hand to the forward grab handle and your left hand to the lower inside cab grab handle. See Fig. 3.12. Hold on very tightly

and maintain three-point contact with the cab at all times.

6. Then, slowly move your left foot to the threshold of the door.
7. Holding tightly to the lower inside cab grab handle with your left hand, move your right hand to the upper inside cab grab handle. See **Fig. 3.12**.
8. With both of your hands gripping the inside cab grab handles tightly, step into the cab with your right foot.
9. With your right foot securely in the cab and both hands gripping the inside cab grab handles, move your left foot into the cab.

Exiting the Passenger's Side Using the Cab Access Stairs for Right-Hand-Drive Vehicles (Fig. 3.12)

WARNING

If the optional cab access stairs do not move into position or if there is not enough room for them to deploy, use the fixed steps on the outside surface of the moving stairs (Fig. 3.5) and follow the access instructions for the standard fixed step system. Freightliner recommends you practice using the fixed steps until you are familiar with their use.

Enter the cab only as specified in the following steps. Keep your body close to the cab and maintain three-point contact with the cab at all times. This means one hand and two feet, or two hands and one foot. Do not lean out away from the cab. Do not engage in horseplay. Do not enter the cab with dirty or greasy hands or feet. Disregarding this careful step-by-step procedure can result in your falling from the cab and possible personal injury or death.

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the upper inside cab grab handle (**Fig. 3.12**) and stand in the threshold of the door, facing into the cab.
2. With your right hand, grasp the forward grab handle.
3. Move your right foot very carefully to the top step.
4. Move your left hand to the lower inside cab grab handle and grip it tightly.
5. Move your left foot to the next step.
6. Maintaining three-point contact with the cab at all times, very carefully move your left hand to the cab forward outside grab handle. Then, move your right hand to the cab aft outside grab handle.
7. Move your right foot to the bottom step.
8. Step to the ground with your left foot.
9. Let go of the grab handles.

Exiting the Cab When the Access Stairs Do not Fully Deploy

Close the door.

- Make sure the park brake is applied.
- Look to see if there is an obstruction in the travel path of the steps.
- Start the engine to increase battery voltage.
- If the vehicle is parked at an incline greater than 3.5 degrees (fore-aft or side-to-side), move it to a level surface (if conditions permit).

Open the door. If the steps will not fully deploy, but will return to a fully stowed position, the steps can be temporarily disabled by depressing the step toggle switch on the dash panel *and* opening the door at the same time. Exit the cab using the instructions for fixed access steps.

Exiting the Cab When the Access Stairs Do not Fully Stow

Open and close the door. If the steps do not fully stow, check the following items:

- Look to see if there is an obstruction in the travel path of the steps.
- Start the vehicle to increase the battery voltage.
- If the truck is parked at an incline of greater than 3.5 degrees (fore-aft or side-to-side), move it to a level surface (if conditions permit).

Open and close the door. If the steps will not stow after the above action items have been checked, attempt to stow the steps as follows:

1. Leave the door open and exit the cab from the opposite side.
2. Place a hand on the exterior surface of the step, then apply light pressure to the step and close the door.
3. If the step stows, press the yellow disable button next to the grab handle. This will disable the step for one deploy and stow cycle.
4. If the steps will not fully stow, follow the instructions on the inside of the baggage door to safely stow the steps.

Exterior Cab Grab Handles and Fixed Access Steps

Entering the Driver's Side (Fig. 3.5)

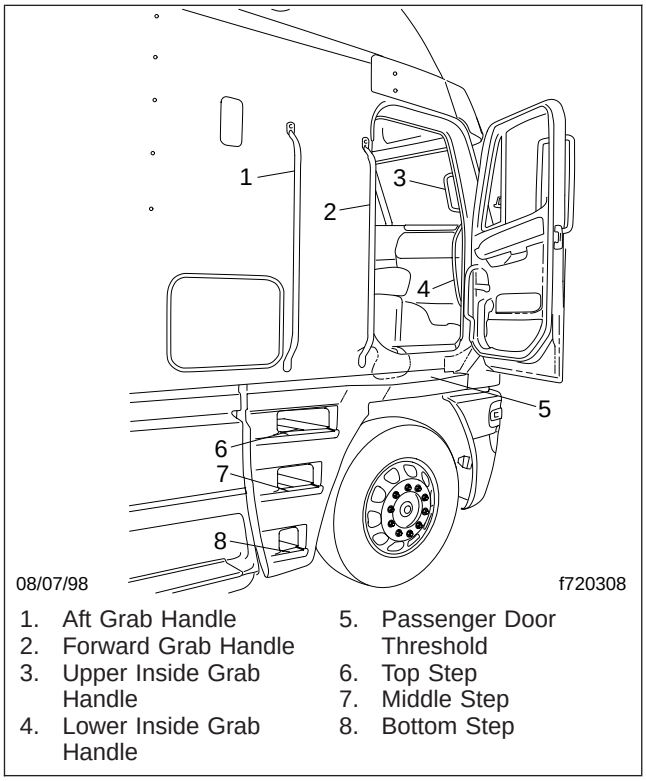
1. Open the driver's door and place anything that you are carrying in the cab.
2. Grasp the aft grab handle with your right hand and grab the forward grab handle with your left hand. Reach up as far as you're comfortable.
3. Place your right foot on the bottom step and carefully pull yourself up.
4. Slowly place your left foot on the next step.
5. Place your right foot on the top step.
6. Grasp the steering wheel with your left hand and step up into the cab.

Exiting the Driver's Side (Fig. 3.5)

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the steering wheel tightly with both hands and stand on the door threshold, facing into the cab.
2. With your right hand, grasp the forward grab handle at the aft edge of the door.
3. Move your right foot to the top step.
4. Move your left hand to the forward grab handle. Then move your right hand to the aft grab handle.
5. Step to the middle step with your left foot.
6. Step to the bottom step with your right foot.
7. Step to the ground with your left foot.
8. Let go of the grab handles.

Entering the Passenger's Side (Fig. 3.13)



1. Aft Grab Handle
2. Forward Grab Handle
3. Upper Inside Grab Handle
4. Lower Inside Grab Handle
5. Passenger Door Threshold
6. Top Step
7. Middle Step
8. Bottom Step

Fig. 3.13, Passenger's Side Steps and Grab Handles

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle with your left hand.
3. Place your left foot on the bottom step.
4. Grasp the forward grab handle with your right hand.
5. Place your right foot on the middle step and step up to the top step with your left foot.
6. Carefully move your left hand to the forward grab handle. Then, move your right hand to the upper inside grab handle.

7. Place your right foot on the door threshold and step up.
8. Step into the cab with your left foot first.

Exiting the Passenger's Side (Fig. 3.10)

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the upper inside grab handle with both hands and place your right foot on the door threshold while standing up from the seat facing inward.
2. Move your left hand to the forward grab handle.
3. Carefully place your left foot on the top access step.
4. Move your right hand to the forward grab handle. Then, move your left hand to the aft grab handle.
5. Place your right foot on the middle step.
6. Place your left foot on the bottom step.
7. Step to the ground with your right foot.
8. Let go of the grab handles.

Entering the Driver's Side for Right-Hand-Drive Vehicles (Fig. 3.14)

1. Open the driver's door, and place anything that you are carrying in the cab.
2. Grasp the aft grab handle with your left hand and grab the forward grab handle with your right hand. Reach up as far as you're comfortable.
3. Place your left foot on the bottom step and carefully pull yourself up.
4. Slowly place your right foot on the next step.
5. Place your left foot on the top step.
6. Grasp the steering wheel with your right hand, and step up into the cab.

Exiting the Driver's Side for Right-Hand-Drive Vehicles (Fig. 3.14)

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the steering wheel tightly with both hands, and stand on the door threshold, facing into the cab.

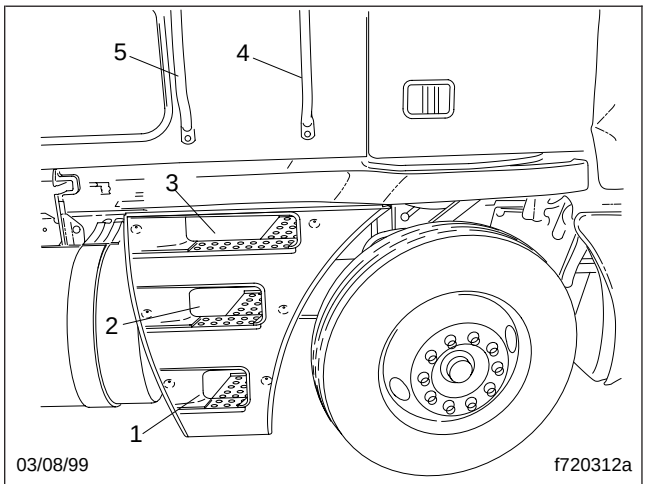
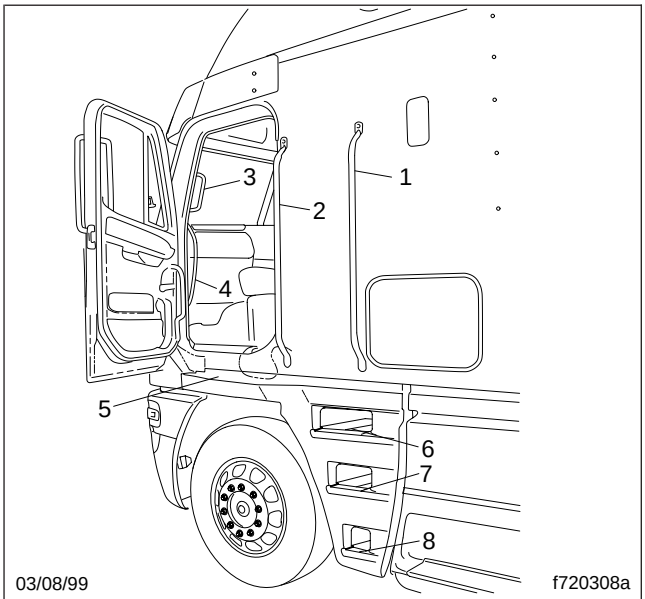


Fig. 3.14, Right-Hand-Drive Fixed Access Steps and Grab Handles, Driver's Side

2. With your left hand, grasp the forward grab handle at the aft edge of the door.
3. Move your left foot to the top step.
4. Move your right hand to the forward outside cab grab handle. Then move your left hand to the aft grab handle.
5. Step to the middle step with your right foot.
6. Step to the bottom step with your left foot.
7. Step to the ground with your right foot.
8. Let go of the grab handles.

Entering the Passenger's Side for Right-Hand-Drive Vehicles (Fig. 3.15)

1. Open the passenger's door, and place anything that you are carrying in the cab.
2. Grasp the cab aft outside grab handle with your right hand.
3. Place your right foot on the bottom step.
4. Grasp the cab forward outside grab handle with your left hand.
5. Place your left foot on the middle step and step up to the top step with your right foot.



1. Aft Grab Handle
2. Forward Grab Handle
3. Upper Inside Cab Handle
4. Lower Inside Cab Handle
5. Passenger Door Threshold
6. Top Step
7. Middle Step
8. Bottom Step

Fig. 3.15, Right-Hand-Drive Passenger's Side Steps and Grab Handles

6. Carefully move your right hand to the cab forward outside grab handle. Then, move your left hand to the upper inside cab handle.
7. Place your left foot on the door threshold and step up.
8. Step into the cab with your right foot first.

Exiting the Passenger's Side for Right-Hand-Drive Vehicles (Fig. 3.15)

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the upper inside cab handle with both hands, and place your right foot on the door threshold while standing up from the seat facing inward.
2. Move your right hand to the cab forward outside grab handle.
3. Carefully place your right foot on the top access step.
4. Move your left hand to the cab forward outside grab handle. Then, move your right hand to the cab aft outside grab handle.
5. Place your left foot on the middle step.
6. Place your right foot on the bottom step.
7. Step to the ground with your left foot.
8. Let go of the grab handles.

Door Windows

The windows in both doors operate manually or electrically (if so equipped). Use the crank handle or the appropriate switch to raise or lower a door window.

Sleeper Compartment Vents

To open any sleeper compartment vent, push the vent handle outward and forward with your fingertips. To close the vent, turn your hand so that your fingers are pulling on the handle from the front edge, then pull in and back on the handle. Use care to avoid pinching your fingers.

Circuit Breaker/Relay Panel

The circuit breaker/relay panel is located in front of the passenger's seat under the top cover of the instrument panel. To access the compartment, press the button labeled PRESS and lift the top dash panel. See **Fig. 3.16**.

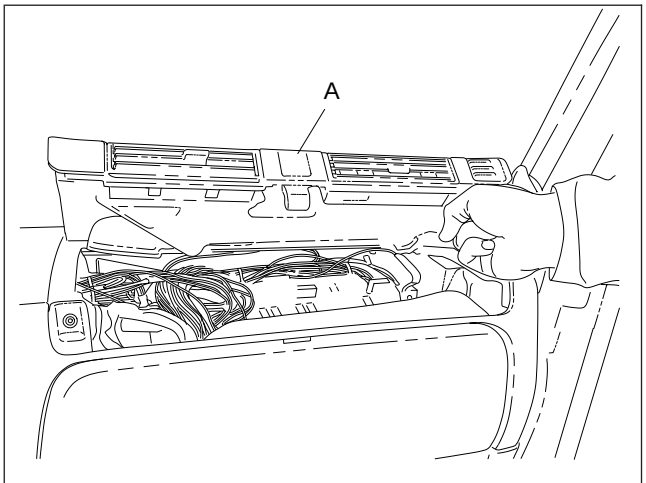
Cab-to-Sleeper Access

⚠ WARNING

Place rigid or heavy objects in storage areas on the floor or under the bunk. Sudden stops or swerves could cause personal injury if items fall from overhead storage shelves.

To open the sleeper access on vehicles with vinyl sleeper curtains, unzip the sleeper curtains. If desired, unsnap the curtains all the way around the sides and top, and remove the curtains.

To open the sleeper access on vehicles with velour sleeper curtains, unfasten the snaps at one side, then push the curtain to the opposite side.



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A. Press this button.

Fig. 3.16, Circuit Breaker/Relay Panel

Sleeper Bunk Latches

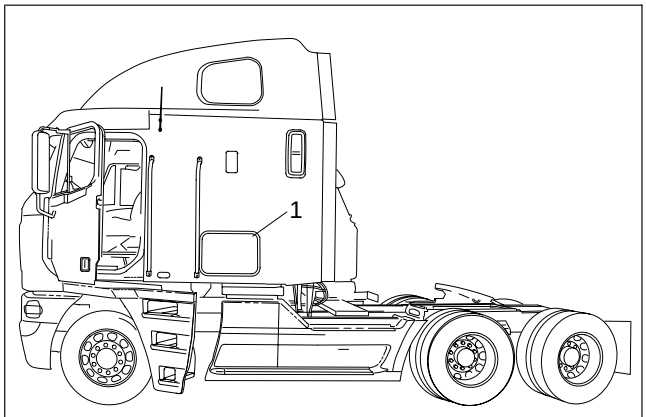
To move the lower or upper sleeper bunk (if equipped), disengage the latch at the front of the lower bunk, or the latches on both sides of the upper bunk. Lock the bunks into operating position, down for the lower bunk and up or down for the upper bunk, by engaging both the primary and secondary latches.

Baggage Compartment Doors

To unlock the baggage compartment doors (**Fig. 3.17**), pull the release handle just inside the lower rear corner of the driver or passenger doors. See **Fig. 3.18**. To close the compartment doors, press them flush with the cab skin.

Back-of-Cab Grab Handles, Steps, and Deck Plate

When trailer air and electrical connections cannot be coupled from the ground, Federal Motor Carrier Safety Regulations require commercial carriers to provide back-of-cab access (**Fig. 3.19**).



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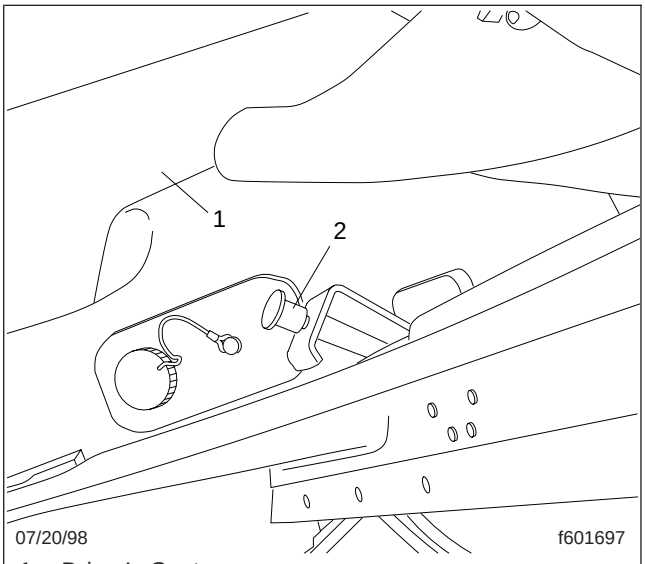
1. Compartment Door

Fig. 3.17, Baggage Compartment Door, Driver's Side



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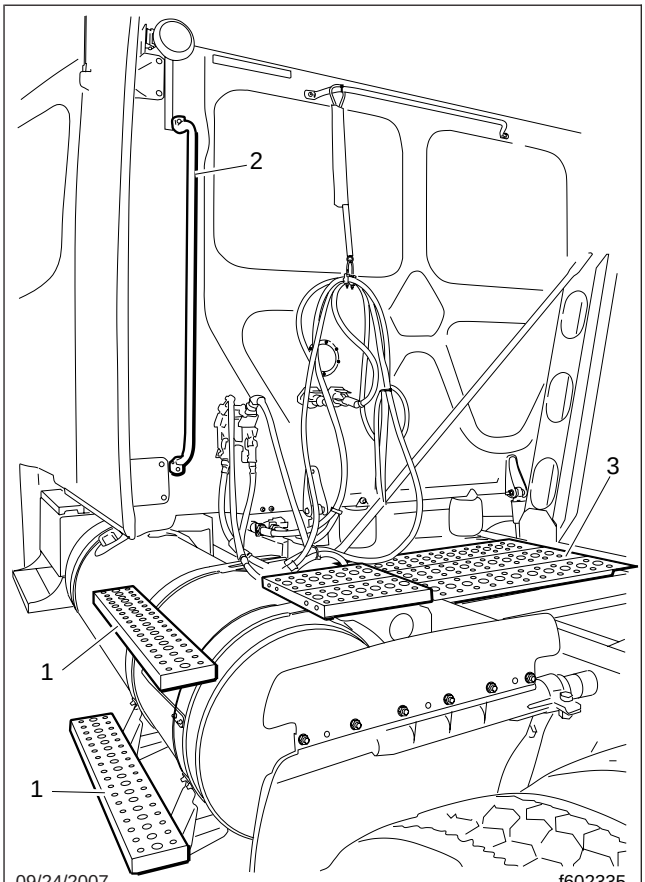
1. Driver's Seat
2. Baggage Compartment Door Release

Fig. 3.18, Baggage Door Release Location

⚠ WARNING

Follow these rules for back-of-cab access. Failing to follow these rules could lead to a fall, and possible personal injury.

Never step on any exterior part unless it has a slip-resistant surface meant for safe stepping. If the surface is movable, such as a battery box



1. Steps
2. Grab Handle
3. Deck Plate

Fig. 3.19, Back-of-Cab Access

cover with a slip-resistant surface, be certain it is firmly secured.

Be careful not to trip on items such as chains or air lines in the back-of-cab area.

Always follow safety procedures for back-of-cab access, maintaining three-point contact—both hands and one foot, or both feet and one hand—whenever moving around, and always face in toward the deck plate when climbing up or down.

Wet or dirty shoes, steps, or grab rails greatly increase the chance of slipping or falling. If your shoes or the contact areas are wet or dirty, clean and dry them as much as possible before accessing the back of cab area, and be especially careful when climbing or standing on the vehicle.

Never jump onto, or off of, a vehicle; doing so creates a very high likelihood of a fall and personal injury.

A grab handle and steps facilitate safe climbing up or down.

Accessing Back-of-Cab Area

When climbing onto the deck plate, use the grab handle and access steps as follows:

1. Facing the center of the deck plate, grasp the grab handle with both hands. Reach up as far as is comfortable.
2. Place one foot on the bottom step, and pull yourself up.
3. Place your other foot on the top step.
4. Move your lower hand to a higher position on the grab handle.
5. Step onto the deck plate.

Exiting the Back-of-Cab Area

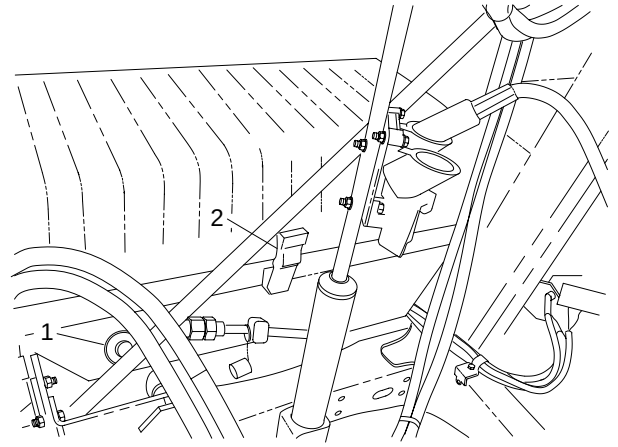
When climbing down from the deck plate, use the grab handle and access steps as follows:

1. Facing the center of the deck plate, grasp the grab handle with both hands.
2. Step one foot at a time to the top step.
3. Move your upper hand to a lower position on the grab handle.
4. Move one foot to the bottom step.
5. Move your upper hand to a lower position on the grab handle.
6. Step to the ground with your upper foot first.

Battery Box Cover

NOTE: On vehicles with vertical-mounted mufflers, you must tilt the cab slightly in order to open the battery box.

To remove the cover from the battery box, release the latch and lift the cover. See **Fig. 3.20**.



1. Battery Disconnect Switch
2. Battery Box Latch

Fig. 3.20, Battery Box

Hydraulic Cab-Tilt System

The hydraulic tilt system used to raise and lower the cab consists of four major parts:

1. A hydraulic pump, which consists of pump body, reservoir, and pump control lever.
2. Two tilt cylinders.
3. Tilt strut on the right-side tilt cylinder.
4. Two hydraulic cab latches.

On vehicles equipped with an optional electric/hydraulic system, an electric motor activates the hydraulic tilt pump. On vehicles equipped with an optional air/hydraulic system, an air motor assembly activates the pump.

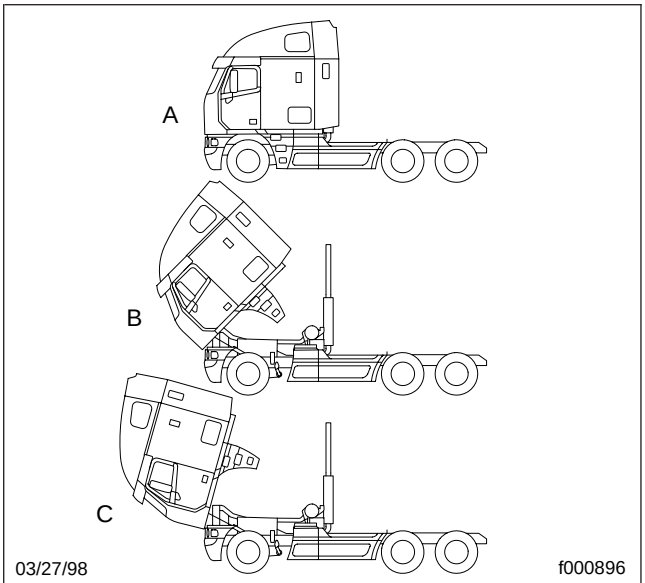
The tilt pump can also be manually operated if necessary.

The hydraulic cab latches are plumbed into the cab tilt system, and open automatically when the cab is tilted. When the cab is returned to the operating position, latch pins on the underside of the cab engage the latch hooks, which lock automatically. Spring force keeps the hooks locked. An indicator pin on the outboard side of each latch protrudes when the latch is unlocked, and recedes when the latch is locked.

⚠ CAUTION

Do not use either the telescoping tube assembly or the hydraulic tilt cylinder as a step or handhold; you could damage the transmission, telescoping tube assembly, or the tilt cylinder.

The tilt cylinders lift the cab to a 45 degree angle, and from a full-tilt position back to 45 degrees. See **Fig. 3.21**. The rate of cab descent beyond overcenter (in either direction) is controlled by the tilt pump.



A. Upright or Operating Position
B. 45° Tilted Position (balance position)
C. Full-Tilt Position

Fig. 3.21, Cab Tilt Positions

A pump handle is located in the baggage compartment for manually working the tilt pump.

Hydraulic Lockup

Hydraulic lockup can occur for the following reasons:

- very cold temperatures
- use of the wrong hydraulic fluid
- air in the system
- sudden cab movement
- a ruptured hydraulic line

- continued pumping after the cab goes over-center
- tilt strut in locked position while lowering the cab

Any of the above situations will cause the velocity fuses to function as check valves, and lock up the tilt cylinders. To unlock the cylinders, the cab must be moved in the opposite direction of travel.

For example, if the cab is moving toward the full-tilt position when the lockup occurs, move the control lever to "Lower," and work the pump a few strokes. This will unlock the cylinders. Move the control lever to "Raise," and allow the cab to descend to a full-tilt position.

If the cab is moving toward the lowered (operating) position when the lockup occurs, move the control lever to "Raise," and work the pump a few strokes. This will unlock the cylinders. Move the control lever to "Lower," and allow the cab to descend to the operating position.

Tilting the Cab

⚠ WARNING

Before tilting the cab, make sure there is adequate clearance in front of the vehicle and that the area is free of people and objects.

Do not tilt the cab with the engine running. Tilting the cab could engage the transmission. If the engine is running, the vehicle could move, causing an accident that could result in personal injury or property damage.

⚠ CAUTION

On the 90-inch cabs with stairs on the right-hand side, you must deploy the stairs before tilting the cab. Tilting the cab with the stairs stowed will cause damage to the vehicle.

IMPORTANT: Before tilting or lowering the cab, read the warning label on the tilt pump and the tilt instructions label on the exhaust stack.

1. If equipped with an air/hydraulic tilt system, build the system air pressure to 100 psi (689 kPa). Then, with the vehicle parked on level ground, shut down the engine, and place the shift lever in the neutral position.

⚠ WARNING

Objects falling in the cab or a door flying open could damage the vehicle or cause personal injury.

2. Secure all loose articles in the cab and bunk, and make sure the doors are securely latched.
3. Apply the parking brakes.
4. If the vehicle is equipped with an electric/hydraulic tilt system, activate the tilt system power switch on the dash.
5. Check the cab travel path for obstructions.
6. Move the pump control lever to the "Tilt" position.
7. Stand clear of the cab travel path.
8. Using either the air or electric motor control button (if so equipped) or the pump handle (located in the baggage compartment), operate the tilt pump to disengage the hold-down latches.

IMPORTANT: Check the indicator pin on each cab latch. The latches have disengaged if the pins are out. See **Fig. 3.22**.

NOTE: If air is present in the hydraulic tilt system, pump operation will seem "spongy" or ineffective. If this happens, bleed the air from the system. For instructions, see **Group 60** of the *Century Class Trucks Workshop Manual*.

⚠ DANGER

Make sure the safety stop is engaged on the right tilt cylinder rod. If the safety stop isn't engaged, and the cab should drop, the result could be serious injury or death.

9. When the cab reaches a 30 degree angle, stop working the pump. Engage the safety stop on the right tilt cylinder rod. See **Fig. 3.23**. The safety stop prevents the cab from accidently dropping below this position.

IMPORTANT: If the cab stops moving while it is being raised, don't force it to move with the tilt pump. The velocity fuses have locked up the tilt cylinders. To unlock them, see "Hydraulic Lockup."

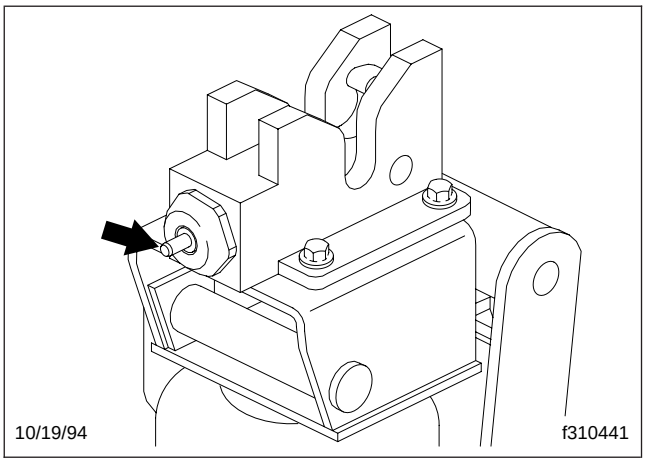


Fig. 3.22, Indicator Pin

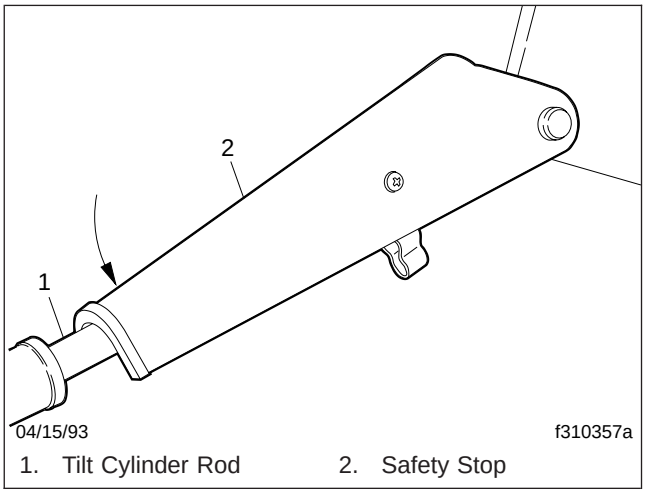


Fig. 3.23, Safety Stop Engaged

10. To tilt the cab all the way, continue working the pump until the cab nears a 45 degree angle (the balance point). Reduce pumping speed. Once the cab goes beyond 45 degrees, stop working the pump. The cab will gently descend to a full-tilt position. To slow cab descent, reverse the tilt pump lever after the cab passes the balance point.

IMPORTANT: If the cab stops after it has gone beyond 45 degrees, don't force it down with the tilt pump. The velocity fuses have locked the tilt cylinders. To unlock them, see "Hydraulic Lockup."

Returning the Cab from a Tilted Position

⚠ DANGER

Stay completely clear of the cab's travel path at all times. Once the safety stop has been released, don't lean over the frame rails, the engine, or the transmission for any reason. To do so could result in serious injury or death.

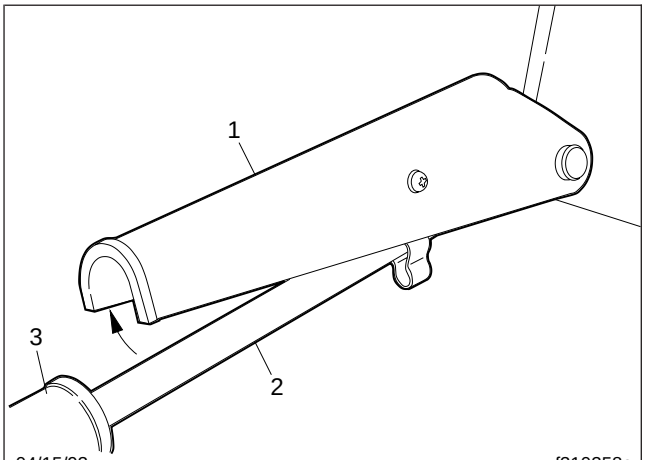
1. Secure all loose articles in the cab and bunk, and make sure the doors are securely latched.
2. Make sure the parking brakes are applied.
3. Move the pump lever to the "return" position.
4. If the vehicle is equipped with an electric/hydraulic tilt system, make sure the tilt system power switch on the dash is activated.
5. Check the cab travel path for obstructions.
6. From full tilt, operate the cab tilt pump until the cab reaches the balance point. From that point, the cab will continue to lower.

NOTE: To slow the cab descent, reverse the tilt pump lever after the cab passes the balance point.

7. Allow the cab to lower to the safety stop.
8. Move the safety stop away from the right tilt cylinder rod (you may need to raise the cab slightly). See **Fig. 3.24**.
9. Lower the cab to the operating position and make sure the cab latches engage.

IMPORTANT: If the cab stops after it has gone beyond 45 degrees, don't force it down with the tilt pump. The safety stop is in the locked position or, the velocity fuses have locked the tilt cylinders. Release the safety stop or, to unlock the fuses, see "Hydraulic Lockup."

10. Leave the pump lever in the "return" position.
11. If the vehicle is equipped with an electric/hydraulic tilt system, switch off the tilt system dash switch.
12. Push the transmission shift lever forward to lock the shift tube latch mechanism.



1. Safety Stop
2. Tilt Cylinder Rod
2. Tilt Cylinder

Fig. 3.24, Safety Stop Disengaged

13. Check the indicator pin on each cab latch. The latches are locked when the pins have moved back into the piston and cylinder spring assembly.

NOTE: Maintain the hydraulic oil level at the oil fill plug. Add oil only when the cab is in the operating position. Use only Freightliner approved hydraulic oil. See **Group 60** of the *Century Class Trucks Maintenance Manual*.

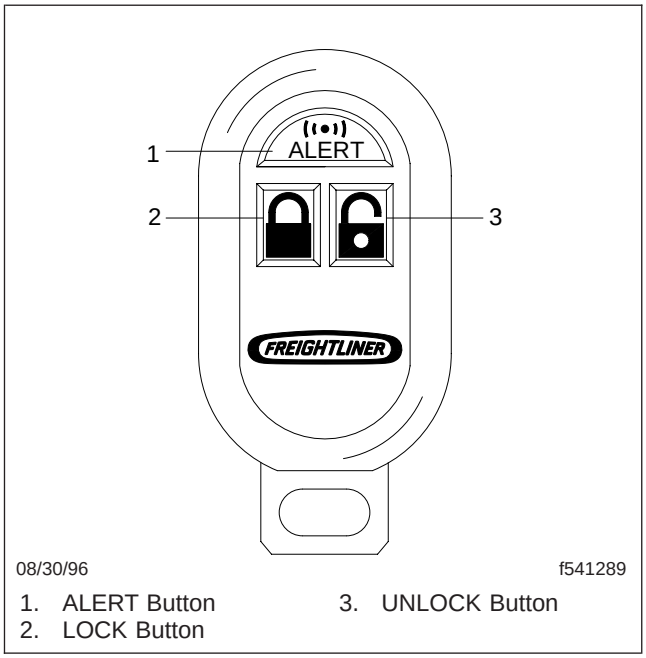
Keyless Security System (optional)

General Information

The optional Meritor keyless security system is a complete vehicle security system. If installed, it locks and unlocks the doors, protects against theft, and provides security for the driver while sleeping or resting inside the vehicle.

The system consists of the following components:

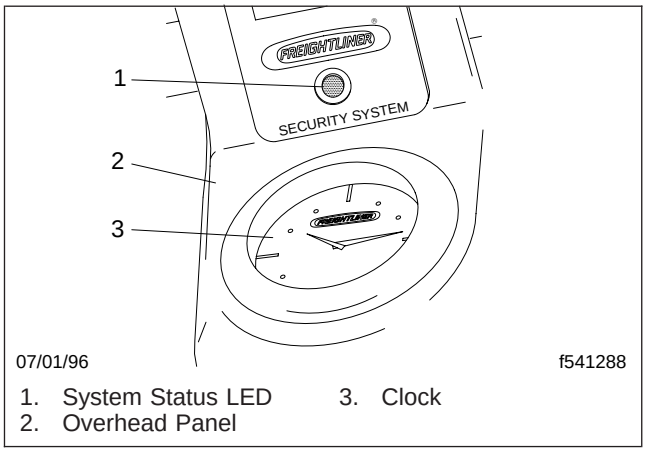
- A hand-held radio frequency transmitter that looks like a key chain fob. It acts as a remote control for locking the doors, unlocking the doors, or placing the system on alert. Each system allows as many as four different fobs. See **Fig. 3.25**.



1. ALERT Button
2. LOCK Button
3. UNLOCK Button

Fig. 3.25, Key Chain Fob (radio transmitter)

- A red system-status LED (light-emitting diode) mounted on the overhead panel above the clock. The LED flashes slow or fast to indicate what state the system is in: armed, alert, alarmed, or violated. It is off when the system is disarmed. See **Fig. 3.26**.

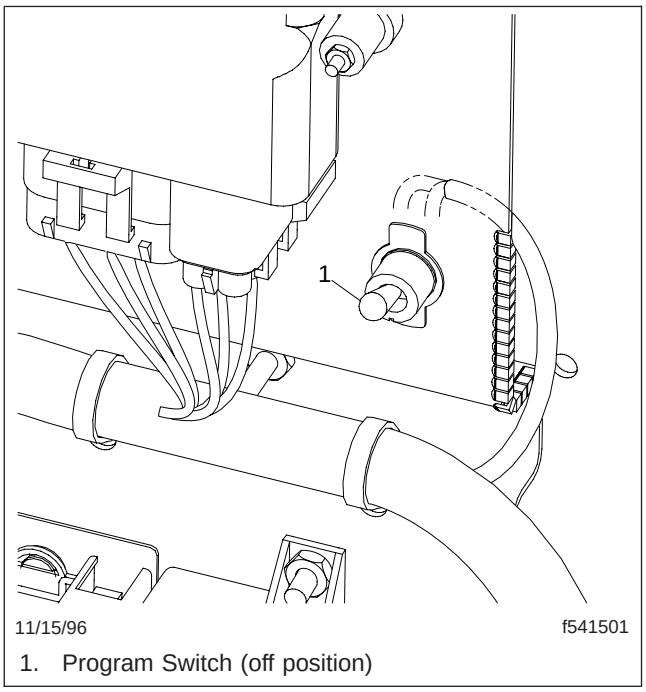


1. System Status LED
2. Overhead Panel
3. Clock

Fig. 3.26, Red System-Status LED

- A Meritor relay module mounted behind the right-hand B-pillar electrical compartment door that arms and disarms the system and programs the fobs.

- A program switch on the Meritor relay module that places the relay module in the learning mode, which is the only state in which the system can learn fob ID codes. The switch is shown in its normal, or OFF, state (toggle pointing up). See **Fig. 3.27**.



1. Program Switch (off position)

Fig. 3.27, Program Switch

- A security system electronic control module (ECM), also mounted behind the right-hand B-pillar electrical compartment door, that monitors all the entry points, controls the door locks, operates the alarm, and interrupts the power to the engine, as necessary. There is also a PDM (power distribution module) relay module mounted on top of the left-hand side of the ECM.

How It Works

The fob has three push buttons: LOCK, UNLOCK, and ALERT. When a button is pushed, the fob sends a radio frequency signal to the ECM. The signal contains a unique vehicle access code that identifies the individual fob, plus codes that indicate which button has been pushed.

The ECM detects the signal sent by the fob, amplifies it and converts it to a digital sequence.

If the LOCK button is pressed, the ECM arms the system. It locks the two cab doors, begins to monitor all the entry points (the two cab doors, the sleeper cab access door, and the two baggage doors, as installed), and instructs the relay module to start flashing the system LED at the slow rate. If any entry points are open, the ECM sounds the horn and flashes the cab marker lights twice. If the ignition key switch is turned off, the ECM interrupts ignition power to the engine.

The driver may be inside or outside the vehicle. However, if the engine is running at the time the LOCK button is pressed, the system still enters the armed state, except that the engine is not immobilized. This improves security for the occupant as well as comfort while sleeping or resting, because the system is armed, and the heating or air conditioning is operating without draining any batteries.

Once the system is armed, the alarm functions activate whenever one of the entry points is opened. In the alarmed state, the ECM does the following:

- Immobilizes the vehicle by cutting off power between the ignition key switch and the engine electronic control unit (ECU).
- Sounds the horn in pulses of 0.5 second on, 0.5 second off.
- Flashes the cab marker lights in pulses of 0.5 second on, 0.5 second off.
- Changes the blink rate of the LED from slow to fast.

If the UNLOCK button is pressed, the ECM disarms the system, if armed. It unlocks all the entry points, discontinues its monitoring of the entry points, instructs the relay module to stop flashing the system LED, and restores ignition power to the engine, if interrupted.

If the ALERT button is pressed, the ECM executes the unlock sequence and also activates the vehicle alarm functions (see above). To cancel an ALERT (to turn off the alarm), press the UNLOCK button.

Once activated, the alarm sequence continues for 30 seconds unless deactivated by pressing the UNLOCK button on the fob. After 30 seconds in the alarmed state, the system automatically enters the violated state.

In the violated state, the horn does not sound and the cab marker lights do not flash, but the engine is

still immobilized and the LED continues to blink at the fast rate. The vehicle remains in this state until the UNLOCK button is pressed.

Fob Programming

The security system ECM can store up to four fob identification codes. Once the first fob has been programmed, there are never any vacant memory locations.

IMPORTANT: As a security measure, all fobs must be coded during the same programming sequence. The first fob code is stored in all four memory locations. Taken together, these ensure that only the vehicle owner's fobs can be programmed into the system. If additional fobs are programmed, they overwrite the original code in locations two, three, and four, in that order.

The ECM provides a 20-second time period to program each fob. If the fob is not programmed within this time span, the system will exit the programming sequence.

After each valid code storage sequence, the system LED will indicate the completion of a learning cycle by turning off the LED for approximately 0.5 second, and unlocking the doors.

To program a fob, do the following steps:

1. With the ignition key switch turned off, turn the program switch ON (flip the toggle DOWN). See **Fig. 3.27**.
2. Now turn the ignition key switch on. Note that the system LED illuminates continuously. See **Fig. 3.26**. This indicates that the ECM is ready to begin the learning sequence.

NOTE: If the LED does not illuminate continuously at this point, repeat the first two steps.

3. On the fob, press down both the LOCK and UNLOCK buttons at the same time and hold them down for at least three seconds. See **Fig. 3.25**. If the code was learned, the system LED flashes and the doors unlock.

IMPORTANT: If no valid code was received, the system does not erase any stored data in that memory location. This is a security measure to ensure that a fob ID cannot be erased accidentally.

4. Repeat the above step to program additional fobs, up to a total of four.
5. When the programming sequence is over, return the system to normal operation by turning the program switch OFF (flip the toggle UP).

Fob Battery Replacement

1. Open the battery cover on the back of the fob with a suitable coin or other thin piece of metal. Twist off the cover. See **Fig. 3.28**.

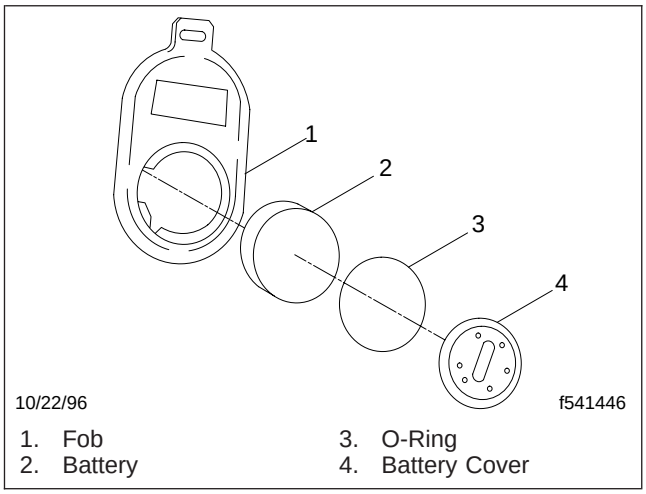


Fig. 3.28, Fob Battery

2. Remove the battery and the O-ring installed inside the cover. Save the O-ring for later installation.

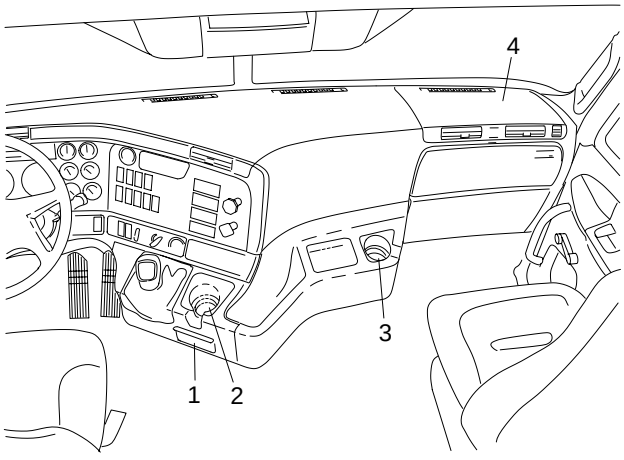
IMPORTANT: The battery may contain perchlorate material; special handling may apply, see **www.dtsc.ca.gov/hazardouswaste/perchlorate**.

3. Install the new battery, as follows.
   - 3.1 Insert the new battery into the fob. Make sure the battery is right side up.
   - 3.2 Install the O-ring as removed. If the O-ring is damaged, or there are signs of moisture inside the fob, replace the O-ring.
   - 3.3 Twist on the battery cover and check it to make sure it is tight.
4. Check the fob for correct operation.

Cab Amenities

Cup Holders

The Century Class vehicle features two cup holders. The driver's cup holder is located above the ash tray on the lower dash panel. See **Fig. 3.29**. The passenger's cup holder is on the lower dash panel near the passenger's seat.



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1. Ash Tray
2. Driver's Cup Holder
3. Passenger's Cup Holder
4. Electrical Access Panel

Fig. 3.29, Cab Amenities

Ash Tray and Cigar Lighter

The driver's ash tray and cigar lighter assembly is on the right side of lower dash panel. See **Fig. 3.29**.

Map Holder

An elastic-topped pouch is located above each door. These are intended for holding maps and other items.

Glove Box

Some vehicles have two glove boxes and two small overhead bins, all located in the overhead console assembly. See **Fig. 3.30**. Above the sun visors on both the driver's and the passenger's sides are the glove boxes with latched doors or netted openings. In the middle section of the console assembly are two small bins. The driver's-side bin is often removed and replaced with a CB radio. The grille underneath this portion of the console allows the radio's speaker to be heard.

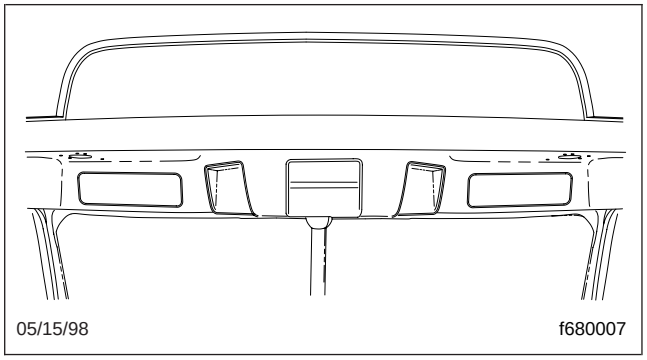

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Fig. 3.30, Glove Boxes and Overhead Storage

Overhead Lights

Above both the driver's and the passenger's seats are three oval-shaped lights mounted to the bottom of the overhead console: A red light and two white lights. The red light is mounted nearest to the windshield. Each light is activated by pushing on the lens cover. Also, the center light, a white light, activates when the doors to the vehicle are opened.

Courtesy Lights

There are optional red lights mounted underneath the dash on the driver's and the passenger's sides of the vehicle. These lights are activated by a rocker switch on the lower dash panel next to the climate control switches.

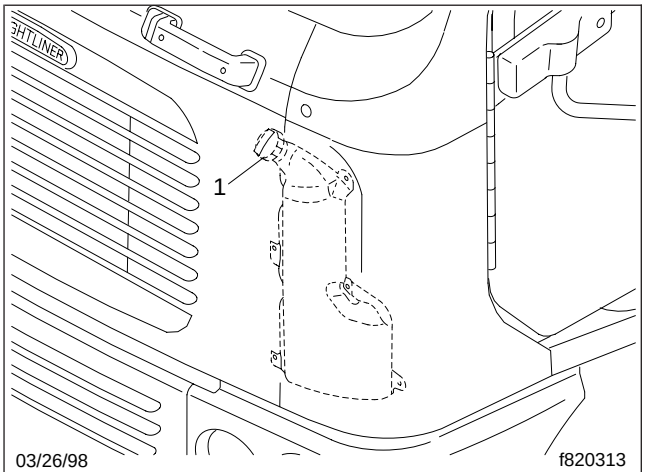
Windshield Washer Reservoir

The windshield washer reservoir is located on the left-hand side of the frontwall, behind the access panel. See **Fig. 3.31**.

Cab Front Access Panel

⚠ CAUTION

Step back from the front access panel when opening it. The access panel can open quickly and could hit a person, possibly resulting in personal injury.

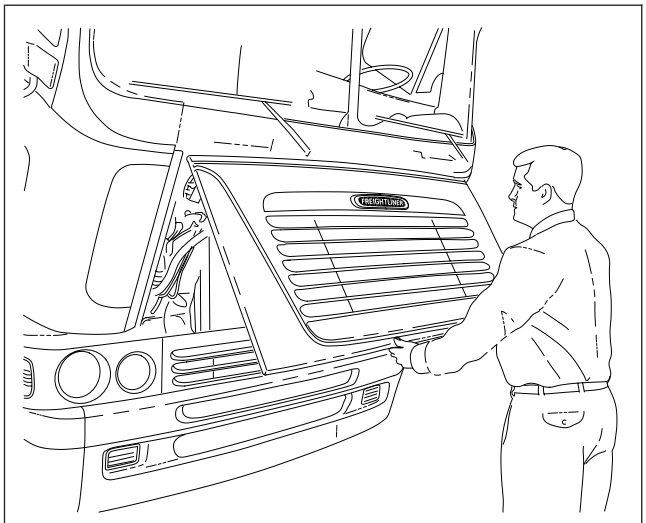


1. Washer Reservoir

Fig. 3.31, Windshield Washer Reservoir

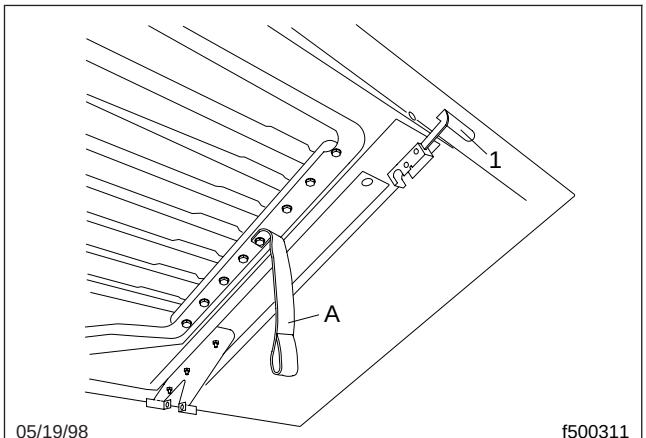
The front access panel (**Fig. 3.32**) allows the driver access to the engine oil dipstick, the coolant fill cap, and the windshield washer reservoir. To open the panel, reach under the lower edge of the panel and release the two latches located near the lower corners. See **Fig. 3.33**. You must hold the left-side latch open while lifting the access panel in order to hold the secondary latch open. With the latches released, grip the panel firmly with both hands, and lift. The panel will stay open until you grab the strap and pull it shut.

Make sure the panel is shut securely and both latches latch.



NOTE: The cab is shown partially tilted.

Fig. 3.32, Opening the Front Access Panel



A. Use this strap to close the access panel.
1. Access Panel Left-Hand Latch

Fig. 3.33, Access Panel, Inside View

4

Heater and Air Conditioner

HVAC General Information 4.1
Defogging and Defrosting Using Fresh Air 4.2
Heating 4.2
Air Conditioning 4.3
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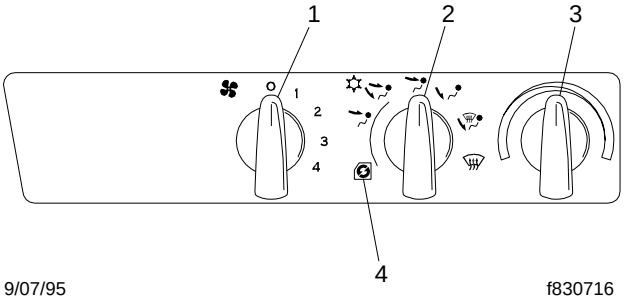
Air Conditioning, Auxiliary (Sleeper Bunk) Heater and Air Conditioner 4.4

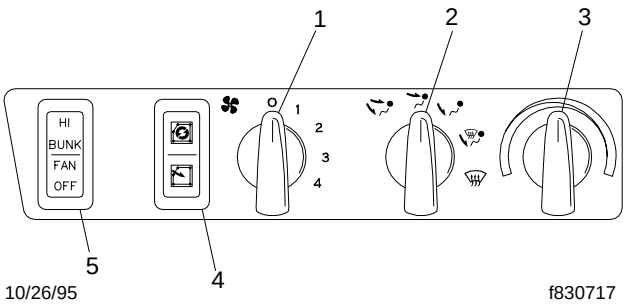
HVAC General Information

A dash-mounted climate control panel (**Fig. 4.1** or **Fig. 4.2**) allows you to control all of the heating, air conditioning, defrosting, and ventilating functions.



1. Fan Switch
2. Air Selection Switch
3. Temperature Control Switch
4. Maximum Air Conditioning

Fig. 4.1, Climate Control Panel, Heater and Air Conditioning



1. Fan Switch
2. Air Selection Switch
3. Temperature Control Switch
4. Fresh Air/Recirculation Switch
5. Auxiliary (sleeper bunk) Switch

Fig. 4.2, Climate Control Panel, Heater Only

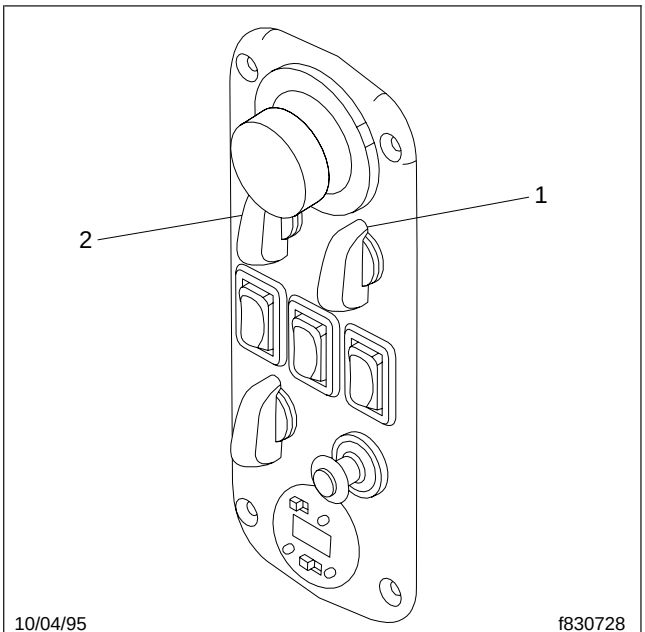
A four-speed fan forces fresh or recirculated air to any selected air outlets at the windshield, door windows, dashboard face, and cab floor.

An air selection switch controls the direction of warm or cool air to the face and feet, face only, feet only, feet and windshield, or windshield only (defrost).

A temperature control switch is used to select the desired temperature. Turn the switch counterclockwise for cool air, or clockwise for warm air.

All of the dash-face outlets have adjustable louvers that pivot right and left, and up and down. The outlets can be closed by moving the louvers all the way down. Windshield defrost outlets and the passenger's door window defrost outlet have nonadjustable louvers. The bunk outlet (at the right-hand rear corner of the bunk) has two sets of vertical louvers that operate like the horizontal dash-face louvers.

An auxiliary heater and air conditioner unit is standard when there is a sleeper compartment. The unit is installed in the right side sleeper baggage compartment and uses the cab's refrigerant liquid system for air conditioner operation. The unit is equipped with a separate evaporator coil, expansion valve, and fan. It is also equipped with its own heater core and water valve, independent of the cab heater. The auxiliary unit's climate control panel (**Fig. 4.3**) is mounted on the right rear wall or the rear overhead storage compartment.



1. Temperature Control Knob
2. Fan Control Knob

Fig. 4.3, Auxiliary (sleeper bunk) Control Panel

NOTE: Shutting off the heater supply gate valve (if equipped) on the engine limits the ability to control air conditioning temperature in the cab and in the sleeper. With the valve shut off, warm coolant is no longer available from the engine,

and the outlet air temperature controls can't be used to change air temperature.

A fresh air/recirculation switch (**Fig. 4.2**) is standard equipment when there is no air conditioning. This control is an option when air conditioning is ordered. It allows the cab to be ventilated with either fresh or recirculated air. When the air selection switch is rotated to the maximum air conditioning position (**Fig. 4.1**), the system uses *only* recirculated air, regardless of whether fresh or recirculated air has been selected.

When the air selection switch is set to air conditioning and recirculated air has been selected, the system functions the same as when the air selection switch is set at maximum air conditioning.

The dash mounted auxiliary switch (**Fig. 4.2**) overrides the auxiliary (sleeper) control panel. This switch should be set in the HI (up) position for increased ventilation in the bunk area, the center (middle) position for normal fan and temperature operation, and the OFF (lower) position to cut power to the auxiliary unit.

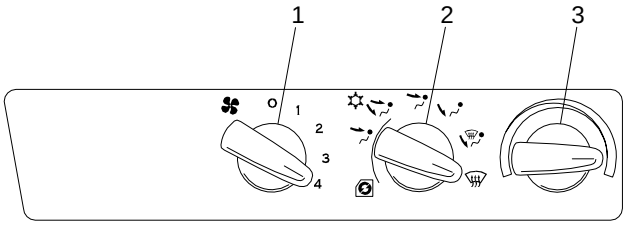
NOTE: When the auxiliary switch is in the OFF (lower) position, the sleeper temperature control will default to the HEAT mode. The sleeper fan will blow hot air when any air conditioning mode is selected. To operate the temperature controls, move the auxiliary switch to the center (middle) position.

A cab exhaust system is included with sleepers. When the climate control unit is set for fresh air, 300 cubic feet per minute of air is provided to the sleeper and exhausted through a vent in the left rear area of the sleeper. When the system is activated, fresh air rapidly displaces stale air as the cab pressurizes.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Defogging and Defrosting Using Fresh Air

1. Turn the temperature control switch all the way clockwise for warm air, the fan switch to OFF and, if so equipped, the bunk fan switch to OFF before starting the engine.
2. Remove any ice or snow from the outside of the windshield, door windows, and fresh air inlet grille.
3. With the engine at operating temperature, turn the fan switch to 4, the highest speed. See **Fig. 4.4**. Leave it in this position for 30 seconds. This will clear the system of moist air.



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1. Fan Switch at Highest Speed
2. Air Selection Switch at Defrost
3. Temperature Control Switch at Warm

Fig. 4.4, Defogging and Defrosting Settings

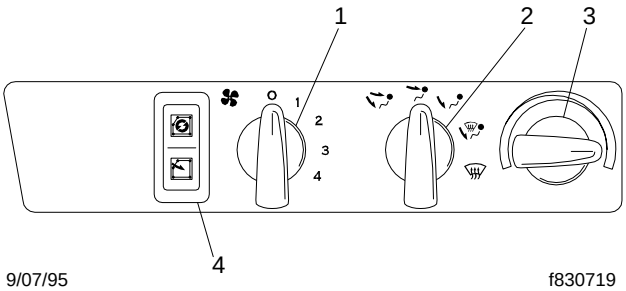
4. Move the air selection switch to the defrost (windshield) position. In this position warm, dry air is directed to the windshield.

NOTE: The air conditioner (if equipped) is automatically engaged in the defrost mode. This dries the air.

Heating

1. With the engine at operating temperature, move the temperature control switch all the way clockwise (for heat). See **Fig. 4.5**.
2. Turn on the fan switch to the desired speed.
3. Move the air selection switch to the desired setting.

IMPORTANT: If the windows start to fog, move the air selection switch to defrost (windshield), and make sure the fan is on. To defog the driver's door window, turn the extreme left dash-face outlet to direct airflow to the upper left.



1. Fan Switch
2. Air Selection Switch
3. Temperature Control Switch at Warm
4. Fresh Air/Recirculation Switch

Fig. 4.5, Heating Settings

NOTE: In mild weather the fan switch can be kept off, since forward motion of the vehicle will provide airflow through the heater.

4. If the vehicle has a sleeper with a rear climate control panel, set the controls as desired. For instructions, refer to "Heating, Auxiliary Heater and Air Conditioner."

5. When a comfortable temperature has been reached, adjust the fan switch setting and temperature control as needed to maintain the temperature.

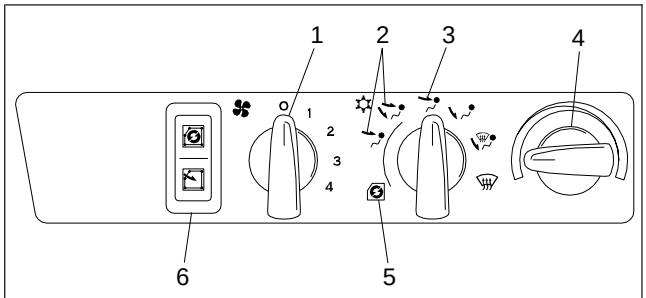
IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Air Conditioning

IMPORTANT: Operate the air conditioner at least five minutes each month, even during cool weather. This helps prevent drying and cracking of tubing seals, reducing refrigerant leaks in the system. Operate the air conditioner only after the engine compartment is warm, and the interior of the cab is 70°F (21°C) or higher. During cold weather, the heater can be operated at the same time, to prevent discomfort.

1. If the cab is hot inside, temporarily open the windows to let the hot air out.

2. Move the air selection switch to the (nonair conditioning) face only position and turn the fan switch off before starting the engine. See **Fig. 4.6**.



1. Fan Switch
2. Air Conditioning Settings
3. Face Only Setting (non-air conditioning)
4. Temperature Control Switch
5. Maximum Air Conditioning
6. Fresh Air/Recirculation Switch

Fig. 4.6, Air Conditioning Settings

3. Start the engine.

4. Move the air selection switch to either one of the air conditioning settings. With the control at either one of the air conditioning settings, fresh air is drawn into the cab. With the control at maximum air conditioning, the air inside the cab is recirculated.

IMPORTANT: If the outside air is dusty or smoky, set the air selection switch at maximum air conditioning and keep the windows and vent closed, to prevent drawing in dust or smoke. On vehicles with the fresh air/recirculation switch, recirculated air can be selected either with the switch or by setting the air selection switch to maximum air conditioning.

5. Move the temperature control switch counterclockwise for cool air. In this position, no heat is given off by the heater.

6. Turn the fan switch to the highest speed, 4.

7. As soon as cool air is flowing from the dashboard outlets, close the windows. Adjust the fan switch setting as desired.

8. If the air from the vents is too cold, move the temperature control switch clockwise for warmer air flow.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Fresh Air

1. Move the fresh air/recirculation switch to the fresh air position. See **Fig. 4.2**. Move the air selection switch to the desired position.
2. Move the temperature control switch counterclockwise for no heating, or move it clockwise for heat.
3. Set the fan switch at the desired speed.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater or ventilation system in a recirculation mode for more than 20 minutes.

Heating, Auxiliary (Sleeper Bunk) Heater and Air Conditioner

1. With the engine at operating temperature, set the three position switch on the main climate control panel on the dash (**Fig. 4.2**) to the middle position.

   The switch in the middle position gives full control of the auxiliary heater/air conditioner to the sleeper bunk mounted control panel. The sleeper bunk fan is turned off when the switch is in the bottom position. The sleeper bunk fan is on high when the switch is in the top position.

NOTE: Whenever the refrigerant compressor is operating, the fan will always run at a very low speed, even with the fan control knob in the "Off" position. This prevents ice from forming on the evaporator, especially during humid weather.

2. Turn the temperature control knob all the way clockwise to HEAT. Turn the fan control knob to position 3. See **Fig. 4.3**.
3. When the sleeper compartment heats to the desired temperature, turn the temperature control knob counterclockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

   The system will automatically maintain the selected outlet air temperature.
4. Whenever heat is not desired, turn the temperature control knob counterclockwise (as needed) and turn off the fan.

IMPORTANT: To prevent the buildup of fumes or odors inside the sleeper (for example, from smoking) *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Air Conditioning, Auxiliary (Sleeper Bunk) Heater and Air Conditioner

1. Turn on the cab air conditioner (refer to "Air Conditioning") and set the three position switch on the main climate control panel on the dash (**Fig. 4.2**) to the middle position.

   The switch in the middle position gives full control of the auxiliary heater/air conditioner to the sleeper bunk mounted control panel. The sleeper bunk fan is turned off when the switch is in the bottom position. The sleeper bunk fan is on high when the switch is in the top position.
2. Turn the temperature control knob all the way counterclockwise to COOL. Turn the fan control knob to position 3. See **Fig. 4.3**.
3. When the sleeper compartment cools to the desired temperature, turn the temperature control knob clockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

   The system will automatically maintain the selected outlet air temperature.
4. Whenever air conditioning is not desired, turn the temperature control knob clockwise (as needed) and turn off the fan.

IMPORTANT: To prevent the buildup of fumes or odors inside the sleeper (for example, from

smoking) *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

NOTE: Whenever the refrigerant compressor is operating, the fan will always run at a very low speed, even with the fan control knob in the "Off" position. This prevents ice from forming on the evaporator, especially during humid weather.

5

Seats and Seat Belts

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Seat Belts and Tether Belts 5.5
Sleeper Compartment Restraints 5.8
Supplemental Restraint System, Optional 5.9
Air Bag, Optional 5.9
SPACE System, Optional 5.10

Seats

General Information

Unless otherwise noted, all seat adjustments should be made while seated and before the engine is started.

Due to the maximum adjustability of mid- and high-back air suspension seats, it is possible to combine the seat back recline adjustment and the seat slide adjustment so that the seat back contacts the back-wall. It is the responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

⚠ WARNING

Keep hands, tools, and other objects away from the scissor points under the seats. Failure to do so could cause personal injury.

Seat Adjustment

The following is a description of adjustments that can be made to various Freightliner-installed seats. Not all seats have all of the adjustments listed below. See **Fig. 5.1**.

1. Back Cushion Tilt: This adjustment enables the back cushion to pivot forward or backward.
2. Lumbar Support: Lumbar support changes the shape of the seat-back to give more or less support to the occupant's lumbar (lower back) area. This adjustment is either mechanical or air controlled, depending on make and model of the seat.
3. Isolator: This feature (also referred to as back-slap isolator or Chugger-Snubber®) reduces the amount of road shock by isolating the occupant from the motion of the vehicle, and allowing the upper seat to move in a simple pendulum motion. A lockout feature is used whenever the isolator is not desired.
4. Height Adjustment: The entire seat moves up or down when adjusting the height. The adjustment is either manually or air controlled, depending on the make of the seat.
5. Bottom Cushion Angle or Fore and Aft Bottom Cushion Height: This feature enables the occupant to raise or lower the front or back of the bottom cushion. This adjustment is easier to perform when all weight is removed from the seat.
6. Fore and Aft Seat or Seat Track Adjustment: The entire seat moves forward or backward when this adjustment is made.
7. Seat Tilt: When this adjustment is made, the seat assembly (back and bottom cushions) tilts forward or backward.
8. Upper Back Cushion Adjustment: When this adjustment is made, the upper back cushion changes angle to provide upper back support.
9. Weight Adjustment: On those seats with weight adjustment, the feature is fully automatic. When you sit on the seat, a leveling valve places you in the center of the ride zone. Additional adjustments are possible by using the height adjustment feature.

EzyRider® Seat

For seat adjustment controls on vehicles built before November 28, 2005, see **Fig. 5.2**. For seat adjustment controls on vehicles built on or after November 28, 2005, see **Fig. 5.3**.

Back Cushion Tilt

To tilt the back cushion, raise the back cushion tilt lever and lean forward or backward. Release the lever to lock the cushion in place.

Lumbar Support

To adjust the amount of support for your lower back, use the lumbar support switch or lever on the side of the seat.

Isolator

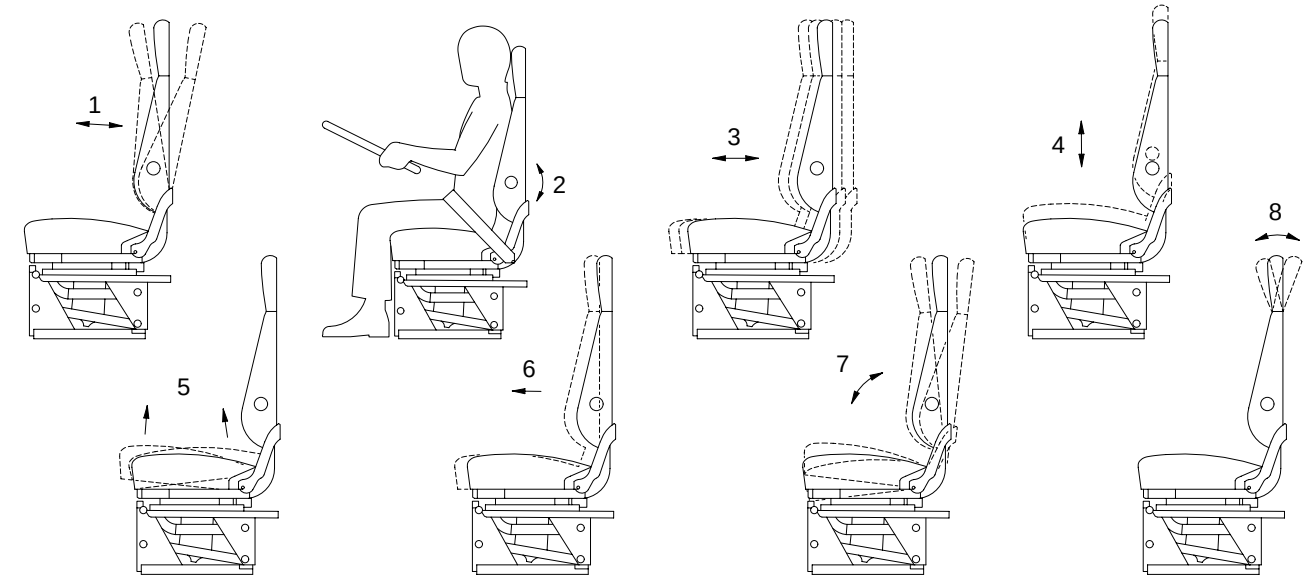
To engage the isolator, push in on the isolator lever. To lock out the isolator, pull the isolator lever out to the first stop.

Fore and Aft Seat Adjustment

Pull the fore and aft seat adjustment lever out to the second stop and slide the seat forward or backward to the desired position.

Height Adjustment

To raise or lower the seat, use the height adjustment switch or lever on the side of the seat.



1. Back Cushion Tilt
2. Lumbar Support
3. Isolator Feature
4. Height Adjustment
5. Bottom Cushion Angle (fore and aft cushion height)
6. Fore and Aft Seat Adjustment (seat track adjustment)
7. Seat Tilt
8. Upper Back Cushion

Fig. 5.1, Seat Adjustments

Bottom Cushion Angle

To adjust the bottom cushion angle, pull the bottom cushion up and forward or down and back. The bottom cushion angle is controlled by the guides on each side of the seat.

Seat Position Indicators

Seats installed in vehicles built before November 28, 2005 are equipped with seat position indicators. A back cushion tilt position indicator and a fore/aft seat position indicator allow the driver to see where the seat is adjusted within the adjustment ranges.

Armrest Angle (optional armrests)

To adjust the vertical angle of the armrest, turn the adjustment knob on the underside of the armrest.

Freightliner/Bostrom Seat

See **Fig. 5.4** for seat adjustment controls.

Back Cushion Tilt

To tilt the back cushion, lean forward slightly to remove pressure from the cushion and hold the back cushion tilt lever rearward. Lean backward slowly to the desired position and release the lever to lock the cushion in place.

Weight and Height Adjustment

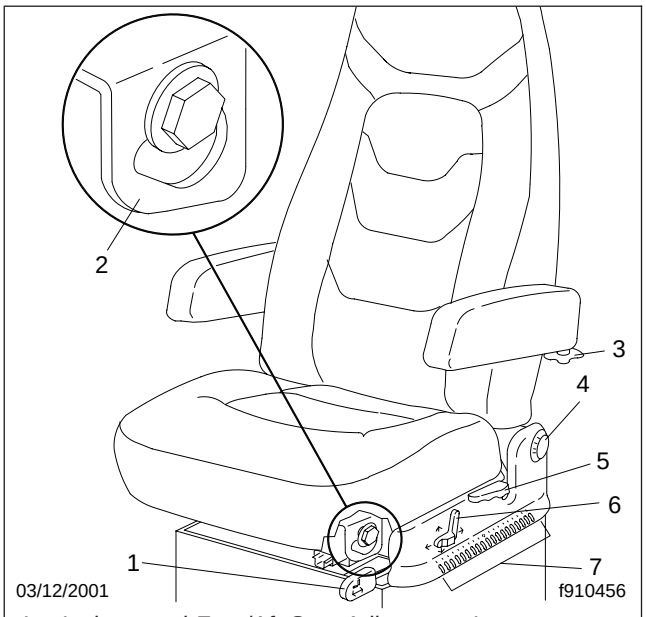
To raise the seat, press the upper portion of the weight and height adjustment switch. To lower the seat, press the lower portion of the switch.

Isolator

To engage the isolator, put the isolator lever in the center position. Lock out the isolator by moving the lever to the right.

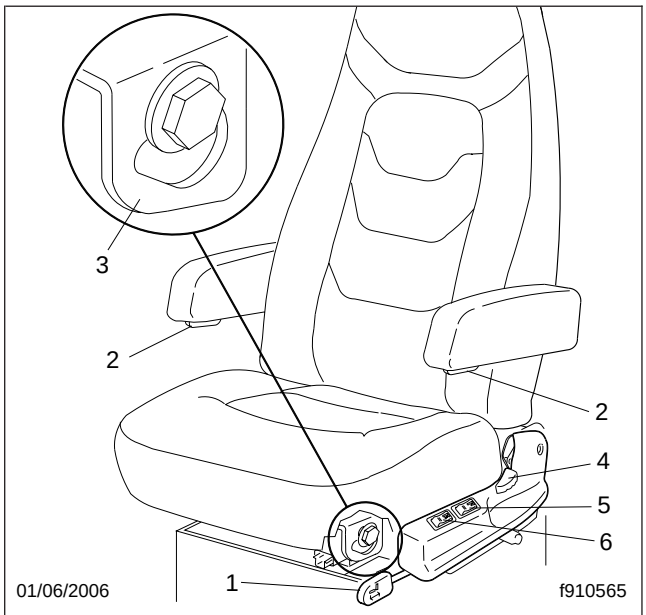
Fore and Aft Seat Adjustment

Hold the fore and aft adjustment lever to the left and slide the seat forward or backward to the desired position.



1. Isolator and Fore/Aft Seat Adjustment Lever
2. Bottom Cushion Angle Guide
3. Armrest Adjustment Knob
4. Back Cushion Tilt Position Indicator
5. Back Cushion Tilt Lever
6. Height Adjustment and Lumbar Support Lever
7. Fore/Aft Seat Position Indicator

Fig. 5.2, EzyRider Seat Adjustment Controls (Vehicles Built Before November 28, 2005)



1. Isolator and Fore/Aft Seat Adjustment Lever
2. Armrest Adjustment Knob
3. Bottom Cushion Angle Guide
4. Back Cushion Tilt Lever
5. Lumbar Support Switch
6. Height Adjustment Switch

Fig. 5.3, EzyRider Seat Adjustment Controls (Vehicles Built on or After November 28, 2005)

Bottom Cushion Tilt Adjustment

Rotate the bottom cushion tilt knob to increase or decrease bottom cushion tilt.

Lumbar Support

To increase lumbar support on LSO models, press the plus sign on the lumbar support switch. To decrease lumbar support on LSO models, press the minus sign on the switch. To increase lumbar support on non-LSO models, rotate the lumbar support knob forward. To decrease lumbar support on non-LSO models, rotate the knob rearward.

Damper Adjustment

Press the damper adjustment switch to adjust the damper.

Dura-Form Fleetcruiser Seat

See **Fig. 5.5** for seat adjustment controls.

Back Cushion Tilt

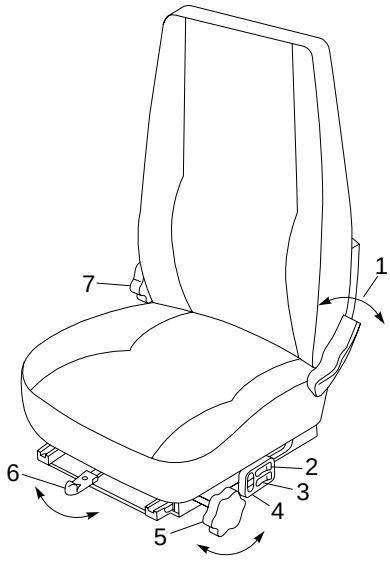
To tilt the back cushion through a range of 10 degrees, push down on the back cushion tilt handle. Move the back cushion to the desired position and release the handle.

Height Adjustment

Push the height adjustment knob in to inflate the suspension and raise the seat. Pull the knob out to deflate the suspension and lower the seat.

Isolator and Fore-Aft Seat Adjustment

Move the fore-aft adjustment lever to the left to adjust the seat to the desired fore-aft position. Move the same lever to the center position to lock out the isolator feature. Move the lever to the right to engage the isolator.



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1. Back Cushion Tilt Lever
2. Lumbar Support Switch (LSO models)
3. Damper Adjustment Switch
4. Weight and Height Adjustment Switch
5. Bottom Cushion Tilt Knob
6. Fore and Aft Adjustment and Isolator Lever
7. Lumbar Support Knob (non-LSO models)

Fig. 5.4, Freightliner/Bostrom Seat Adjustment Controls

Seat Cushion Adjustment

To put the seat cushion in the upper position, lift upward on the front of the cushion, then push rearward. To put the seat cushion in the lower position, pull forward and then push downward.

Lumbar Support

Move the lumbar support lever to any of the three positions as desired.

National 2000 Series Seat

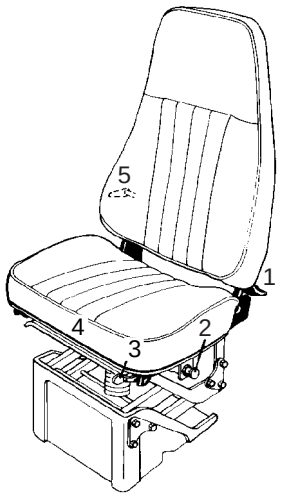
See **Fig. 5.6** for seat adjustment controls.

Back Cushion Tilt

To tilt the back cushion, turn the back cushion tilt knob until the desired position is reached.

Height Adjustment

To raise or lower the height of the seat, use the height adjustment switch on the side of the seat.



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1. Back Cushion Tilt Handle
2. Height Adjustment Knob
3. Isolator and Fore/Aft Adjustment Lever
4. Seat Cushion Adjustment
5. Lumbar Support Lever

Fig. 5.5, Dura-Form Fleetcruiser Seat Adjustment Controls

Fore and Aft Seat Adjustment

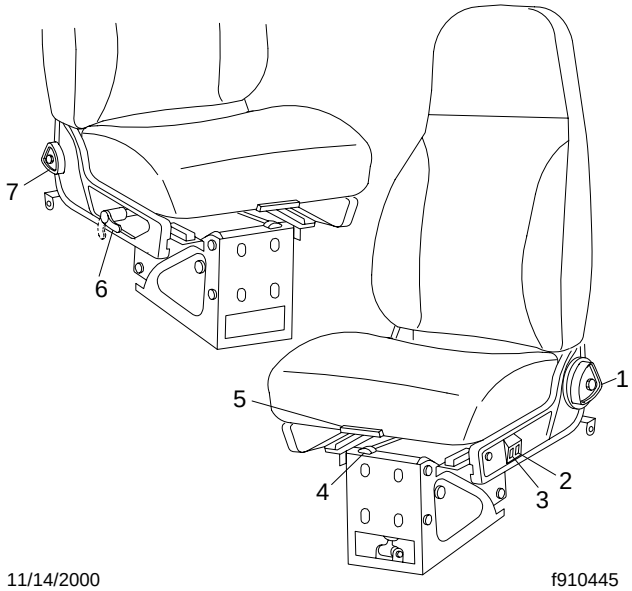
To adjust the fore and aft position of the entire seat, move the fore and aft seat adjustment lever to the left and slide the seat forward or backward to the desired position. Move the lever back to its original position to lock the seat in place.

Rear Cushion Adjustment

To adjust the height of the rear of the seat cushion, remove your weight from the seat and turn the rear cushion adjustment knob to one of three positions.

Isolator

Also called a Chugger Snubber®, the isolator reduces the amount of road shock by isolating the occupant from the motion of the vehicle and allowing the seat to move in a simple pendulum motion. To use the isolator feature, turn the isolator handle to the horizontal position. Turn the isolator handle down when the isolator feature is not desired.



1. Back Cushion Tilt Knob
2. Lumbar Support Switch
3. Height Adjustment Switch
4. Fore and Aft Seat Adjustment Lever
5. Bottom Cushion Front Height Adjustment Handle
6. Isolator Handle
7. Rear Cushion Adjustment Knob

Fig. 5.6, National 2000 Series Seat Adjustment Controls

Lumbar Support

To adjust the lumbar support, use the lumbar support switch on the side of the seat to give more or less support to your lower back.

Bottom Cushion Front Height

To adjust the height of the front of the bottom cushion, lift the bottom cushion front height adjustment handle, and pull forward or push back to the desired setting.

Seat Belts and Tether Belts

General Information

Seat belt assemblies are designed to secure persons in the vehicle to help reduce the chance of injury or the amount of injury resulting from accidents or sudden stops. For this reason, Daimler Trucks North America LLC urges that the driver and *all* passengers, regardless of age or physical condition, use seat belts when riding in the vehicle.

⚠ WARNING

Always use the vehicle's seat belt system when operating the vehicle. Failure to do so can result in severe personal injury or death.

Seat belt assemblies in Daimler Trucks North America (DTNA) vehicles meet Federal Motor Vehicle Safety Standard 209, "Type 1" and "Type 2" requirements.

When transporting a child, always use a child restraint system or the vehicle seat belts as appropriate. To determine whether a child restraint system is required, review and comply with applicable state and local laws. Any child restraint used must comply with Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems." When providing a child restraint system, always carefully read and follow all instructions pertaining to installation and usage for the child. Make certain the child remains in the restraint system at all times when the vehicle is in motion.

In addition to seat belt assemblies, tether belts are installed on suspension-type seats. Tether belts help secure the seat to the floor and are intended to restrain the seat and seat belt in case of an accident or sudden stop.

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

Seat Belt Inspection

⚠ WARNING

Inspect and maintain seat belts and tethers as instructed below. Seat belts and tethers that were damaged or stressed in an accident must be replaced, and their anchoring points must be checked. When any part of a seat belt system needs replacement, the entire seat belt must be replaced, both the retractor and the buckle side. Do not attempt to modify the seat belt system; doing so could change the effectiveness of the system. Failure to replace damaged or stressed

seat belts or any modifications to the system may result in personal injury or death.

Inspect the seat belts and tether belts if so equipped.

1. Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
2. Check the web for extreme dirt or dust, and for severe fading from exposure to sunlight.
3. Check the buckle and latch for operation and for wear or damage.
4. Check the Komfort Latch for function and cracks or other damage.
5. Check the upper seat belt mount on the door pillar for damage.
6. Check web retractor for function and damage.
7. Check the mounting bolts for tightness and tighten any that are loose.

Seat Belt Operation

Three-Point Seat Belt With Komfort Latch

NOTE: For vehicles not equipped with the Komfort Latch, see the seat belt operation under the heading "Three-Point Seat Belt."

⚠ WARNING

Wear three-point seat belts only as described below. Three-point seat belts are designed to be worn by one person at a time. In case of an accident or sudden stop, personal injury or death could result from misuse.

Fasten the seat belts before driving. Fastening a three-point seat belt while driving creates a hazard.

1. Slowly pull the link end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to inboard) far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.
2. Fasten the three-point seat belt by pushing the link into the buckle until it latches (**Fig. 5.7**). Give the belt a tug at the buckle. If the buckle unlatches, repeat this step. If the problem continues, replace the three-point seat belt.

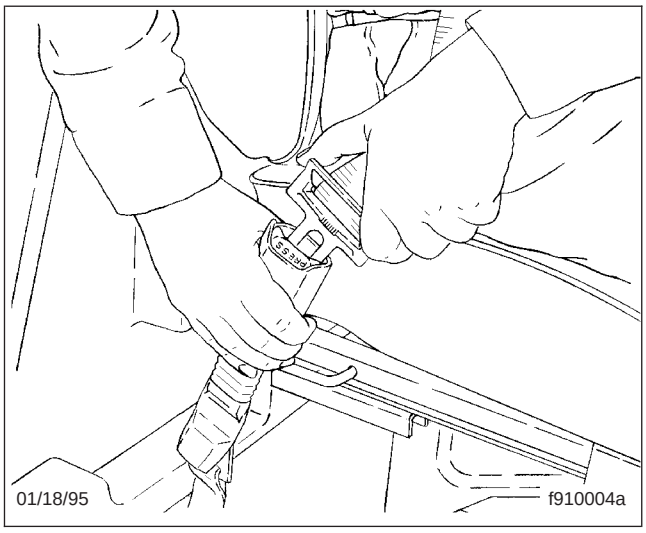
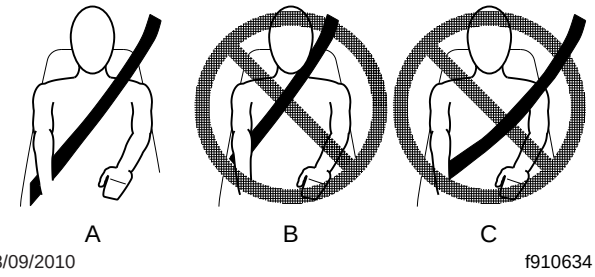


Fig. 5.7, Fastening the Three-Point Belt

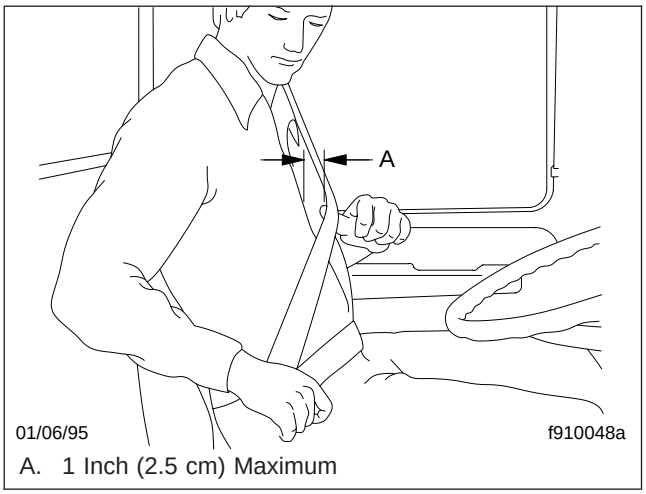
3. Position the shoulder strap diagonally across your chest with the adjustable D-loop bracket (if equipped). The shoulder strap must be centered on your shoulder and chest, away from your face and neck. See **Fig. 5.8**. If desired, engage the Komfort Latch as follows.

   Pull on the shoulder strap to lessen the pressure of the strap on your shoulder and chest. Allow no more than one inch (2.5 cm) of slack between your chest and the shoulder harness. More slack can significantly reduce the seat belt's effectiveness in an accident or a sudden stop. While holding the belt slack, press the Komfort Latch lever up, clamping the seat belt webbing (**Fig. 5.9** and **Fig. 5.10**).



A. Correct—Belt is centered on your shoulder and chest, away from your face and neck.
B. Wrong—Belt must not rub against face or neck.
C. Wrong—Belt must not hang off shoulder.

Fig. 5.8, Proper Shoulder Strap Fit



A. 1 Inch (2.5 cm) Maximum

Fig. 5.9, Adjusting Shoulder Harness Clearance

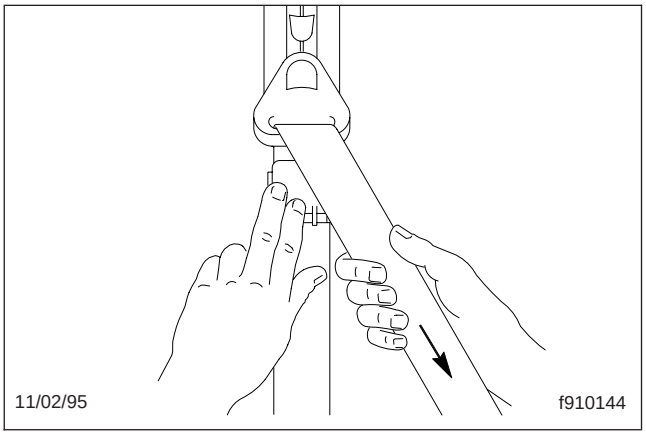


Fig. 5.10, Locking Komfort Latch

4. To unbuckle the three-point seat belt, push the button on the buckle as shown in **Fig. 5.11**. If the Komfort Latch was used, release it by giving the shoulder belt a quick tug. If you lean forward against the shoulder belt, the Komfort Latch will automatically release, and will need to be reset.

NOTE: The Komfort Latch does not have to be released in an emergency situation. The Komfort Latch will release by itself under rough road or other abnormal conditions. Make sure the three-point seat belt is completely retracted when it is not in use.

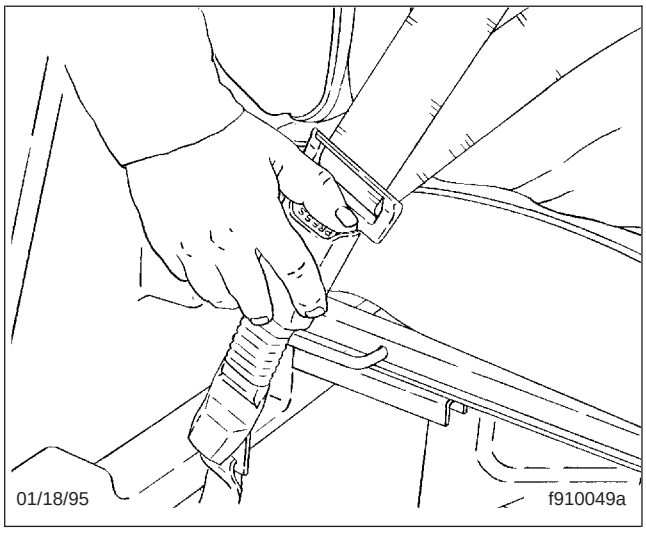


Fig. 5.11, Releasing the Three-Point Seat Belt

Three-Point Seat Belt

NOTE: For vehicles equipped with the Komfort Latch, see the seat belt operation under the heading "Three-Point Seat Belt With Komfort Latch."

⚠ WARNING

Wear three-point seat belts only as described below. Three-point seat belts are designed to be worn by one person at a time. In case of an accident or sudden stop, personal injury or death could result from misuse.

Fasten the seat belts before driving. Fastening a three-point seat belt while driving creates a hazard.

1. Slowly pull the link end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to inboard) far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.
2. Fasten the three-point seat belt by pushing the latch into the buckle. Listen for an audible click. See **Fig. 5.7**.
3. Tug on the seat belt to make sure it is securely fastened. If the buckle unlatches, repeat this step. If the problem continues, replace the three-point seat belt.

4. Snug the seat belt to your waist.
5. Position the shoulder strap diagonally across your chest with the adjustable D-loop bracket (if equipped). The shoulder strap must be centered on your shoulder and chest, away from your face and neck. See **Fig. 5.8**.
6. To unbuckle the three-point seat belt, press the release button on the buckle; see **Fig. 5.11**.

NOTE: Make sure the three-point seat belt is completely retracted when it is not in use.

Sleeper Compartment Restraints

General Information

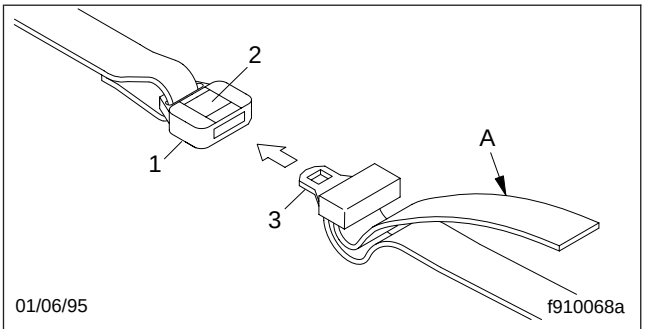
On vehicles equipped with a sleeper compartment, bunk restraints should be used whenever the sleeper compartment is occupied and the vehicle is moving. Restraints are designed to lessen the chance of injury or the amount of injury resulting from accidents or sudden stops. For this reason, Daimler Trucks North America LLC urges the use of bunk restraints when the sleeper compartment is occupied in a moving vehicle.

⚠ WARNING

Do not use the sleeper compartment while the vehicle is in motion unless a bunk restraint is installed and used. Not using the bunk restraint increases the chance of injury, or the degree of injury, from accidents or sudden stops to all occupants of the vehicle.

Bunk Restraint Adjustment

1. Make sure the belt is attached to the bunk support and sleeper wall.
2. To lengthen the belt, tip the link end downward and pull the link until it connects with the buckle.
3. After the belt is connected, shorten it by pulling on the loose end until the belt is snug, but comfortable. Be sure the belts are not twisted. See **Fig. 5.12**.

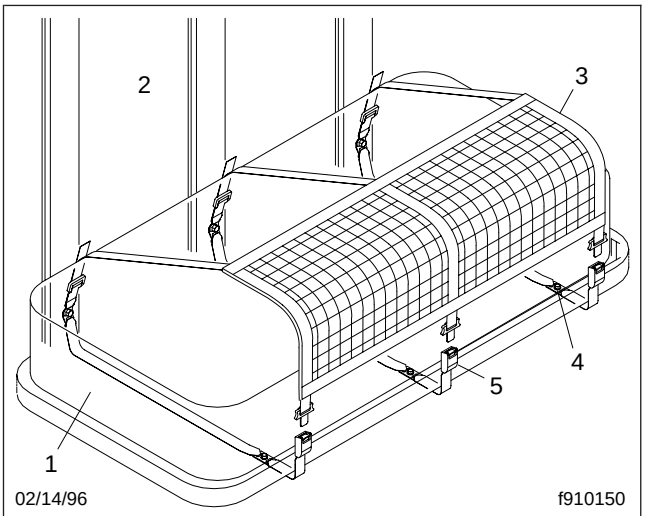


A. Pull on the loose end to shorten the belt.
1. Buckle
2. Belt Release Button
3. Link

Fig. 5.12, Bunk Restraint Adjustment

Bunk Restraint Operation

1. Starting at the foot of the bunk, pull up the link end of the belt far enough to engage the buckle. See **Fig. 5.13**.



1. Mattress
2. Sleeper Wall
3. Restraint
4. Belt Anchor
5. Buckle

Fig. 5.13, Bunk Restraint

2. Fasten the belt by pushing the link end into the buckle until they latch. Make sure that the belt is not twisted. Check the engagement by trying to pull the link out of the buckle. If they come apart, repeat this step. If the problem continues, replace the belt. Repeat steps 1 and 2 for the

other two belts located in the middle and upper portion of the bunk to lock the restraint in place.

3. To release the bunk restraint, push the release button on the buckle at the head of the bunk and pull the link from the buckle.

   Repeat this step for the other two buckles to completely release the bunk restraint.

Supplemental Restraint System, Optional

The supplemental restraint system can consist of an air bag and SPACE system, or an air bag only system. Your vehicle may or may not have a supplemental restraint system.

Air Bag, Optional

The air bag, when used with seat belts, provides additional protection to the driver in severe frontal collisions. The operational readiness of the air bag system is indicated by the supplemental restraint system (SRS) indicator on the dash. The SRS indicator comes on when the engine is started and then goes off. The indicator will remain on if there is a problem with the air bag system. The vehicle should be serviced if the SRS indicator does not come on when the engine is started or if the SRS indicator remains on.

⚠ WARNING

Air bags are designed to inflate only in severe frontal collisions. The driver and the passenger should always wear seat belts. For maximum protection in a collision or rollover, always be in a normal seated position with your back against the seat back and your head upright. Fasten your seat belt and ensure that it is properly positioned on your body as described under the "Seat Belt Operation" heading. Since the air bag inflates with considerable speed and force, a proper seat position will keep you a safe distance from the inflating air bag.

Do not place objects on the steering wheel or between you and the steering wheel. Keep your hands on the sides and lower portion of the steering wheel. Any objects may cause harm during an accident.

Failure to follow these instructions may result in death or personal injury.

Air Bag Safety Guidelines

The air bag system contains components that use combustible chemicals. Because these chemicals are combustible, care must be taken when replacing or handling system components.

⚠ WARNING

Consider undeployed air bags to be dangerous and capable of deploying at any time. Do not attempt to service the air bag system unless trained to do so. Damaged air bag systems should be examined by qualified personnel before any attempt is made to remove or to deploy the air bag. All intentional deployments and testing of the system should be performed by trained personnel. Unintentional or improper air bag deployment could cause severe bodily injury or death.

Do not attempt to disassemble the air bag inflator unit or breach the integrity of the sealed metallic inflator case. Doing so could cause severe bodily injury or death.

Do not allow system chemicals to contact other liquids, combustibles, and flammable materials. Doing so could cause chemical burns or personal injury.

The surface of the deployed air bag may contain small amounts of sodium hydroxide (which is a by-product of the gas generant combustion) and metallic sodium. Sodium hydroxide may be irritating to the skin and eyes. Always wear rubber gloves and safety glasses when handling a deployed air bag. Immediately wash your hands and exposed skin areas with a mild soap and water. Flush your eyes immediately if exposed to sodium hydroxide.

Review and comply with the following list of warnings. Failure to do so could result in severe injury or death.

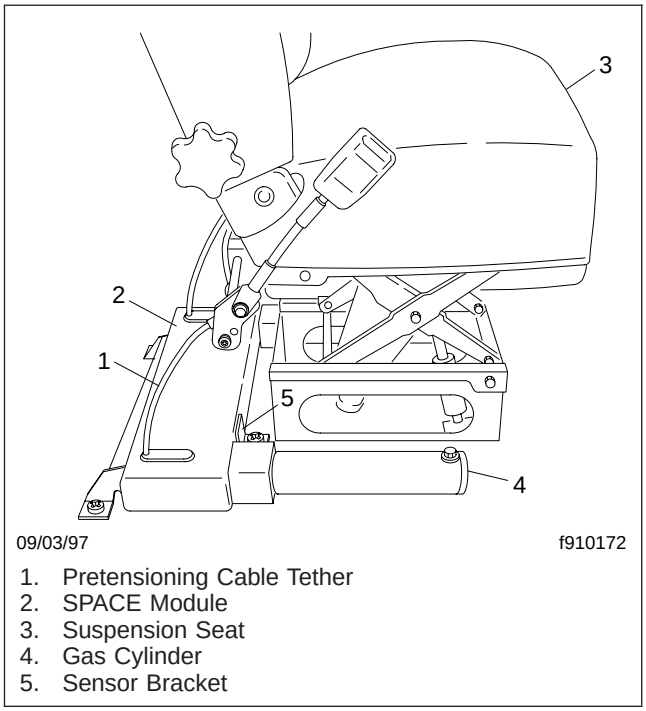
- **Keep all liquids, acids, halogens, heavy metals, and heavy salts away from the air bag system.**
- **Do not cut, drill, braze, solder, weld, strike, or probe any part of the air bag system.**

- **Do not expose the air bag module to electricity. Never probe a circuit.**
- **Do not attempt to adapt, reuse, or install an air bag system in any vehicle other than the specific vehicle for which it is designed.**
- **Do not cut wires or tamper with the connector between the vehicle wiring harness and the air bag module. Cutting or removing the connector from the system will disable the safety shunt and could cause unintentional deployment.**
- **Allow deployed air bag systems to cool after deployment.**
- **Wear rubber gloves and safety glasses when handling a deployed air bag.**
- **Wash your hands and exposed skin surface areas immediately after handling a deployed system.**
- **Store, transport, dispose of, and recycle deployed air bag system components in accordance with all applicable federal, state, and local regulations.**
- **The air bag module may contain perchlorate material: special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.**
- **Keep all heavy objects in the cab secured.**

SPACE System, Optional

The Seat Pretensioner Activation for Crash survival Enhancement (SPACE) system, when used with seat belts, provides additional protection to the driver in severe frontal collisions.

The SPACE system provides a significant increase in seat stability during a severe, frontal collision. When the SPACE module senses a severe, life-threatening frontal impact, the module triggers two gas-cylinders mounted at the base of the seat. See **Fig. 5.14**. The gas cylinders activate the power cinches that then tighten the lap and shoulder belts against the occupant of the seat and lower the seat suspension, moving the occupant down and away from the steering wheel and ceiling. See **Fig. 5.15**. The air bag is activated simultaneously. This sequence of actions occurs in about a tenth of a second.



1. Pretensioning Cable Tether
2. SPACE Module
3. Suspension Seat
4. Gas Cylinder
5. Sensor Bracket

Fig. 5.14, SPACE System Components

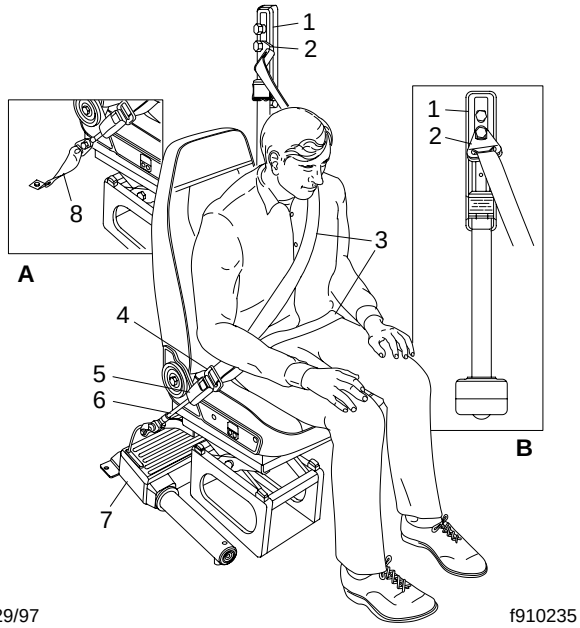
WARNING

The SPACE system will activate during a severe, frontal collision even if the seat belts are not fastened, but the SPACE system only provides protection to the occupant when the seat belts are fastened. Always use the seat belts when operating the vehicle. Failure to do so can result in severe personal injury or death.

WARNING

Damaged seat belts or seat belts that were worn in an accident must be replaced and their anchoring points must be checked. Do not attempt to modify the SPACE system. Doing so could change the effectiveness of the system. The SPACE system must be replaced after being activated. Failure to do so may result in personal injury or death.

Infants and children must not be placed in seats equipped with the SPACE system. The SPACE



A. Seat Tether Without the SPACE System
B. Seat Belt Assembly B-Pillar Components

1. Height Adjuster	5. Buckle
2. Shoulder Loop	6. Buckle Cable
3. Seat Belt	7. SPACE Module
4. Latch	8. Seat Tether

Fig. 5.15, SPACE System Seat Belt Assembly

system is designed for adults only. Failure to follow these instructions may result in personal injury or death.

The operational readiness of the SPACE system is indicated by the supplemental restraint system (SRS) indicator on the dash. The SRS indicator comes on when the engine is started and then goes off. The indicator will remain on if there is a problem with the air bag or SPACE system. The vehicle should be serviced if the SRS indicator does not come on when the engine is started or if the SRS indicator remains on.

Safety Guidelines for the SPACE System

The SPACE system contains components that use combustible chemicals. Because these chemicals are combustible, care must be taken when replacing or handling system components.

⚠ WARNING

Do not attempt to service the air bag/SPACE system. Damaged or deployed air bag/SPACE systems should be examined only by qualified personnel before any attempt is made to remove, replace, or handle the air bag/SPACE system components. All intentional deployments and testing of the system should be performed by trained personnel. Unintentional or improper deployment of the air bag/SPACE system could cause severe bodily injury or death.

Do not attempt to service or to disassemble the SPACE module. The SPACE module cannot be serviced. Doing so could result in severe bodily injury or death.

Although the air bag/SPACE system components will not likely explode, self-deploy, or produce shrapnel, care must be taken when it is necessary to replace or perform work around the air bag/SPACE system components. Review and comply with the following list of warnings. Failure to do so could result in severe injury or death.

- **Do not cut, drill, braze, solder, weld, strike, or probe any part of the air bag/SPACE system.**
- **Keep all liquids, acids, halogens, heavy metals, and heavy salts away from the air bag/SPACE system.**
- **Do not expose the air bag/SPACE system components to electricity.**
- **Do not attempt to adapt, reuse, or install an air bag/SPACE system in any vehicle other than the specific vehicle for which it is designed.**
- **Keep hands and tools away from the scissor points under the seats.**
- **Do not cut wires or tamper with the connectors between the vehicle wiring harness and the air bag/SPACE system. Cutting or removing the electrical connectors could cause unintentional deployment.**
- **Do not expose the air bag/SPACE system to electricity. Never probe a circuit.**

- **Store, transport, dispose, and recycle deployed air bag/SPACE system components in accordance with all applicable federal, state, and local regulations.**
- **Replace damaged seat belts or seat belts that were worn in an accident, and check all anchoring points. Only qualified personnel familiar with air bag/SPACE systems should replace the seat belts used in a vehicle with an air bag/SPACE system.**
- **The air bag/SPACE system requires a special seat belt. Care must be taken to be sure the correct seat belt is used.**
- **Keep all heavy objects in the cab secured.**

6

Steering and Brake Systems

Steering System 6.1
Brake System 6.1

Steering System

General Information

When there is no load on the vehicle, and the front tires are pointed straight ahead, the steering wheel spokes should be centered, ±10 degrees, as shown in **Fig. 6.1**. See **Group 46** of the *Century Class Trucks Workshop Manual* for steering adjustment procedures.

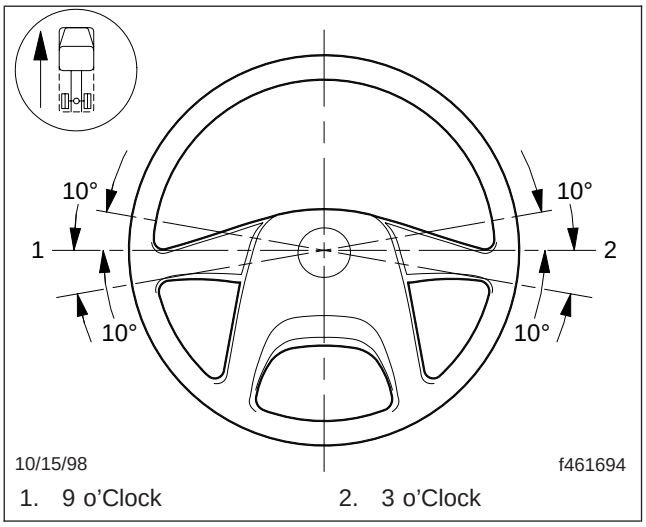


Fig. 6.1, Proper Steering Wheel Position (with tires pointed straight ahead)

⚠ CAUTION

Never steam clean or high-pressure wash the steering gear. Internal damage to gear seals, and ultimately the steering gear, can result.

Power Steering System

The power steering system consists of an integral steering gear (which includes a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder), hydraulic hoses, power steering pump, reservoir, and other components. Some models are also equipped with a separate hydraulic power cylinder on the right side of the front axle. The power steering pump, driven by the engine, provides the power assist for the steering system. If the engine is not running, there is no power assist. If the power-assist feature does not work due to hydraulic fluid loss, steering pump damage, or some other cause, bring the vehicle to a safe stop. Do not drive the vehicle until the cause of the problem has been corrected.

⚠ WARNING

Driving the vehicle without the power-assist feature of the steering system requires much greater effort, especially in sharp turns or at low speeds, which could result in an accident and possible injury.

Drivers should carefully use the power available with a power steering system. If the front tires become lodged in a deep chuckhole or rut, drive the vehicle out, instead of using the steering system to lift the tires from the hole. Also, avoid turning the tires when they are against a curb, as this places a heavy load on steering components and could damage them.

Brake System

General Information

A dual air brake system consists of two independent air brake systems which use a single set of brake controls. Each system has its own reservoirs, plumbing, and brake chambers. The primary system operates the service brakes on the rear axle; the secondary system operates the service brakes on the front axle. Service brake signals from both systems are sent to the trailer.

⚠ WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control resulting in property damage or personal injury.

Loss of air pressure in the primary system causes the rear service brakes to become inoperative; front brakes will continue to be operated by secondary system air pressure. In addition, trailer brakes will be operated by the secondary system. Loss of secondary system air pressure causes the front axle brakes to become inoperative; rear service brakes and trailer brakes will be operated by the primary system.

Before driving your vehicle, allow time for the air compressor to build up a minimum of 100 psi (689

kPa) pressure in both the primary and secondary systems. Monitor the air pressure system by observing the dual system air pressure gauge and the low-air-pressure warning light and buzzer. The warning light and buzzer shut off when air pressure in both systems reaches 64 to 76 psi (441 to 524 kPa).

The warning light and buzzer come on if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the dual system air pressure gauge to determine which system has low air pressure. Although the vehicle's speed can be reduced using the foot brake control pedal, either the front or rear service brakes will not be operating, causing a longer stopping distance. Bring the vehicle to a safe stop, and have the air system repaired before continuing.

IMPORTANT: In the event of a total loss of service brakes with full system air pressure, use the parking brake control valve (yellow knob) to bring the vehicle to a complete stop in the safest location possible.

On tractor-trailer vehicles, if both the primary and secondary systems become inoperative, the trailer service brakes or spring parking brakes will automatically apply when air pressure drops below 35 to 45 psi (242 to 310 kPa). The tractor spring parking brakes will automatically apply when air pressure drops below 20 to 30 psi (138 to 207 kPa). On straight trucks, spring parking brakes will apply when air pressure drops below 20 to 30 psi (138 to 207 kPa). Do not wait for the brakes to apply automatically; when the warning light and buzzer first come on, immediately bring the vehicle to a safe stop. Before continuing operation of the vehicle, correct the cause of the air loss.

Before the vehicle can be moved, the spring parking brakes must be released by applying an external air source at the gladhands, or by manually caging the parking brake springs.

⚠ WARNING

Do not release the spring parking brakes and then drive the vehicle. There would be no means of stopping the vehicle, which could result in serious personal injury or vehicle damage. Before releasing the spring parking brakes, make the connection to a towing vehicle or chock the tires.

After correcting the brake system problem, uncage the spring parking brakes before resuming normal vehicle operation.

Brake System Operation

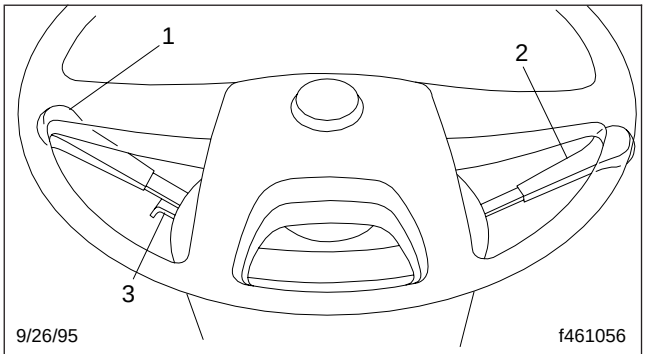
Before driving the vehicle, secure all loose items in the cab so that they will not fly forward during a full brake application. Make sure all passengers are wearing seat belts.

During normal brake stops, depress the foot brake control pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. Apply the spring parking brakes if the vehicle is to be parked.

IMPORTANT: An air brake proportioning system is used in tractor air brake systems when the vehicle is not equipped with ABS. When operating in bobtail mode, the rear brake chambers (whose axle load has been greatly reduced) receive reduced or proportional air pressure, while the front axle brake chambers receive full (normal) air pressure. This results in a different brake pedal "feel," as the pedal seems to require more travel and/or effort to slow or stop the vehicle. However, the air brake proportioning system actually improves vehicle control when the tractor is in the bobtail mode of operation. When the tractor is towing a trailer, the rear brake chambers will receive full (normal) application air pressure.

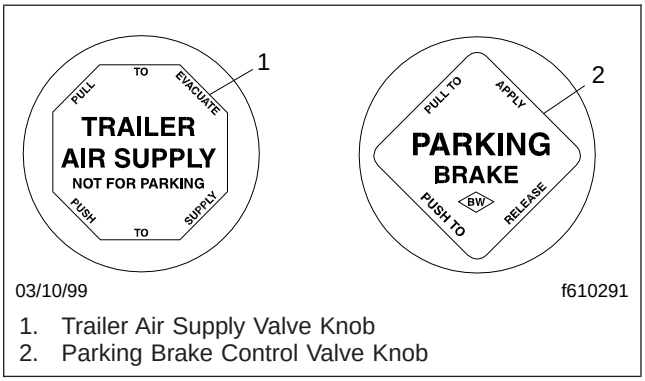
NOTE: If equipped with main and auxiliary transmissions, do not shift both transmissions into neutral while the vehicle is rolling. Shifting both transmissions back into gear would be difficult while the vehicle is rolling.

The trailer brake hand control valve (**Fig. 6.2**) actuates the trailer service brakes independently from the vehicle chassis service brakes. The valve can be partially or fully applied, but in any partially-on position it will be overridden by a full application of the foot brake control pedal. Moving the valve handle clockwise actuates the trailer brakes, while moving it counterclockwise releases the trailer brakes. The valve handle is spring-loaded and returns to it's original, no-air application position when released.



1. Turn Signal Lever
2. Trailer Brake Hand Control Valve
3. Hazard Warning Light Tab

Fig. 6.2, Steering Column-Mounted Controls



1. Trailer Air Supply Valve Knob
2. Parking Brake Control Valve Knob

Fig. 6.3, Brake Valve Knobs

⚠ WARNING

Do not use the trailer service brakes for parking; they are not designed for this purpose. If air bleeds out of the trailer air tank during parking, the vehicle could roll causing serious personal injury or property damage.

The red octagonal-shaped knob (**Fig. 6.3**) in the control panel actuates the trailer air supply valve. After the vehicle's air hoses are connected to a trailer, and the pressure in both air systems is at least 65 psi (448 kPa), the red knob must be pushed in. It should stay in, to charge the trailer air supply system and to release the trailer spring parking brakes; it must be pulled out before disconnecting a trailer. It must also be pulled out when operating a vehicle without a trailer. If pressure in both air systems drops to 35 to 45 psi (242 to 310 kPa), the red knob automatically pops out, exhausting the trailer air supply, and applying the trailer service or spring parking brakes.

The yellow diamond-shaped knob (**Fig. 6.3**) in the control panel actuates the parking brake valve. Pulling out the knob applies both the tractor and trailer spring parking brakes and automatically causes the trailer air supply valve knob to pop out.

⚠ CAUTION

Do not use the spring parking brakes if the service brakes are hot, such as after descending a steep grade. Also, do not use the spring parking brakes during freezing temperatures if the service brakes are wet. To do so could damage the brakes if hot, or cause them to freeze during cold weather.

If the brakes are wet, drive the vehicle in low gear and lightly apply the brakes to heat and dry them. Allow hot brakes to cool before using the spring parking brakes. Always chock the tires.

If the trailer is not equipped with spring parking brakes, pulling out the yellow knob applies the tractor spring parking brakes and the trailer service brakes. When the tractor and trailer parking brakes (or trailer service brakes) are both applied, the trailer brakes are released by pushing in the red knob, leaving the tractor parking brakes applied. Air pressure in the primary or secondary reservoir must be at least 65 psi (447 kPa) before the tractor spring parking brakes, or the trailer service or spring parking brakes, can be released.

On trailers not equipped with spring parking brakes, chock the trailer tires before disconnecting the truck or tractor when parking just the trailer.

When parking a truck or tractor with a trailer (combination vehicle), and the trailer is not equipped with spring parking brakes, apply the truck or tractor spring parking brakes.

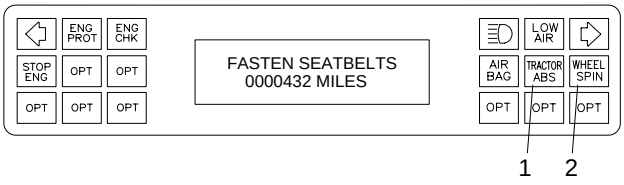
⚠ WARNING

If a trailer is not equipped with spring parking brakes, do not park it or a combination vehicle by pulling out only the trailer air supply valve knob. This would apply only the trailer service brakes. If air were to bleed from the trailer brake system, the trailer brakes would release, possibly causing an unattended runaway vehicle.

⚠ CAUTION

Never apply the service and spring parking brakes simultaneously. To do so transmits excessive input force to the brake components, which could damage or cause eventual failure of brake actuating components.

Meritor WABCO® Antilock Braking System (ABS) (Fig. 6.4)



1. Tractor ABS Warning Light
2. Wheel Spin Indicator Light

Fig. 6.4, ABS Dash Lights

The Meritor WABCO® Antilock Braking System (ABS) is an electronic wheel speed monitoring and control system that works with the standard air brake system. ABS passively monitors vehicle wheel speed at all times, and *controls* wheel speed during emergency stops. If equipped with Automatic Traction Control, wheel spin is controlled during reduced-traction situations. In normal braking applications, the standard air brake system is in effect.

IMPORTANT: For proper ABS system operation, do not change tire sizes. The sizes of the tires installed during production are programmed into the electronic control unit. Installing different sized tires could result in a reduced braking force, leading to longer stopping distances.

ABS includes signal-generating tone wheels and sensors located in the wheel hubs of each sensed wheel. The sensors transmit vehicle wheel speed information to an electronic control unit (located in a panel behind the driver's seat). The control unit's main circuit interprets the speed sensor signals and calculates wheel speed, wheel retardation, and a vehicle reference speed. If the calculations indicate wheel lockup, the main circuit signals the appropriate solenoid control valve to reduce braking pressure. During emergency braking, the solenoid control valve alternately reduces, increases, or maintains air pressure supply in the brake chamber to prevent front and rear wheel lockup.

If equipped with Automatic Traction Control, an additional solenoid valve is installed. During reduced-traction situations, the valve increases or reduces air pressure supply in the brake chamber to provide better traction whenever wheel spin occurs.

The electronic control unit also has a safety circuit that constantly monitors the wheel sensors, traction control valve (if equipped), solenoid control valves, and the electrical circuitry.

After the ignition switch is turned on, the tractor warning light (TRACTOR ABS) and, if equipped with Automatic Traction Control, the wheel spin (WHEEL SPIN) indicator light come on for about three seconds. If a compatible trailer is connected, the trailer ABS lamp will also illuminate. After three seconds, the warning lights go out only if all of the tractor and trailer (if equipped) ABS components are working.

The wheel spin (WHEEL SPIN) indicator light comes on if one of the drive wheels spins during acceleration. The light goes out when the wheel stops spinning. When the light comes on, partially release the throttle pedal until the light goes out. If slippery road conditions continue, engage the axle lock.

⚠ CAUTION

Axle lock should only be engaged when the vehicle is moving slowly at low throttle. Engagement at high speed or power can damage the axle(s).

Do not engage the axle lock while the WHEEL SPIN light is on. To do so could damage the rear axle. See Chapter 9 for axle lock instructions.

Vehicles with electronic engines and ABS may have automatic traction control (ATC). On these vehicles, the ATC system automatically limits wheel spin during reduced-traction situations.

If the vehicle has ATC, there will be a momentary contact rocker switch on the dash labeled NORM/SPIN and ATC.

When the ATC system is in the NORMAL mode, it will apply gentle braking to the spinning wheel, to feed power to the wheel(s) with better traction. If both wheels are spinning, the system will signal the electronic engine to reduce power.

Pressing NORM/SPIN will temporarily allow more drive wheel spin to help burn through a thin layer of ice, or to help throw off accumulated mud or snow. SPIN mode is indicated by a flashing WHEEL SPIN light. Pressing NORM/SPIN again will cycle the system back to normal operation.

The Meritor WABCO® ABS system combines one front-axle control channel with one rear axle to form one control circuit. For example, the sensor and solenoid control valve on the left-front axle form a control circuit with the sensor and solenoid control valve on the right rear axle. If, during vehicle operation, the safety circuit senses a failure in any part of the ABS system (a sensor, solenoid control valve, wiring connection, short circuit, etc.), the tractor warning light (TRACTOR ABS) comes on and the control circuit where the failure occurred is switched to normal braking action. The remaining control circuit will retain the ABS effect. Even if the ABS system is completely inoperative, normal braking ability is maintained. An exception would be if a solenoid control valve (or combination solenoid control valve) is damaged and inoperative. As these components are an integral part of the air brake system, normal braking may be impaired or inoperative.

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, repair the ABS system immediately to ensure full antilock braking capability.

During emergency or reduced-traction stops, fully depress the brake pedal until the vehicle comes to a safe stop; *do not pump* the brake pedal. With the brake pedal fully depressed, the ABS system will control all wheels to provide steering control and a reduced braking distance.

Although the ABS system improves vehicle control during emergency braking situations, the driver still has the responsibility to change driving styles depending on the existing traffic and road conditions. For example, the ABS system cannot prevent an accident if the driver is speeding or following too closely.

Trailer ABS Lamp Operation

Antilock braking systems on tractors are designed to communicate with trailer ABS systems, if they are compatible. Compatibility will result in the illumination of the trailer ABS lamp during vehicle start-up and fault detection.

The dash-mounted lamp will operate as follows when a compatible trailer is properly connected to a tractor:

- When the ignition key is turned to the ON position, the trailer ABS lamp will illuminate momentarily, then turn off.
- If the lamp comes on momentarily during vehicle operation, then shuts off, a fault was detected and corrected.
- If the lamp comes on and stays on during vehicle operation, there is a fault with the trailer ABS. Repair the trailer ABS system immediately to ensure full antilock braking capability.

The Trailer ABS lamp will not illuminate unless a compatible trailer is connected to the tractor.

IMPORTANT: If a compatible trailer is connected, and the lamp is not illuminating momentarily when the ignition key is turned to the ON position, it is possible that the lamp is burnt out.

Automatic Slack Adjusters

Automatic slack adjusters are required on all vehicles equipped with air brakes manufactured after October 20, 1994. Automatic slack adjusters should never be manually adjusted except during routine maintenance of the foundation brakes (e.g., replacing shoes), during slack adjuster installation or in an emergency situation.

When the brake pushrod stroke exceeds the legal brake adjustment limit on a vehicle, there is likely a mechanical problem with the foundation brake components or the adjuster is improperly installed.

Visit a repair facility as soon as possible when brakes equipped with automatic slack adjusters are determined to be out of adjustment.

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. In fact, continual adjustment of automatic slack adjusters may result in premature wear of the adjuster itself. Further, the improper adjustment of some automatic slack adjusters may cause internal damage to the adjuster, thereby preventing it from properly functioning.

7

Engines and Clutches

EPA07 Exhaust Aftertreatment System (ATS) 7.1
Detroit Diesel Heavy-Duty Engine (DD13/15) 7.4
Engine Starting—CAT, Cummins, DDE S60, M-B 7.8
Engine Operation—CAT, Cummins, DDE S60, M-B 7.12
Engine Shutdown—CAT, Cummins, DDE S60, M-B 7.19
Optional Engine Systems 7.21
Clutches 7.27

EPA07 Exhaust Aftertreatment System (ATS)

IMPORTANT: EPA07 emissions regulations apply to vehicles domiciled in Canada and the USA at the time of printing this manual. Vehicles that are domiciled outside of the USA and Canada may not have EPA07-compliant engines with an emission aftertreatment system, depending upon local statutory emissions guidelines.

All on-road diesel engines for vehicles domiciled in the USA or Canada, and built after December 31, 2006, but before January 1, 2010, must meet EPA07 guidelines for reduced exhaust emissions of particulate matter and nitrogen oxides (NOx). NOx is limited to just over 1 gram per brake horsepower hour (g/bhp-hr) and particulate matter cannot exceed 0.01 g/bhp-hr.

NOTICE

It is extremely important that the following guidelines be followed for vehicles with EPA07-compliant engines, or damage may occur to the aftertreatment device, and the warranty may be compromised.

- Use ultralow-sulfur diesel with 15 ppm sulfur content or less.
- Do not use fuel blended with used engine lube oil or kerosene.
- Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.

IMPORTANT: Using non-specification fuels or oils can lead to shortened Diesel Particulate Filter (DPF) cleaning or exchange intervals. For example, using CI-4+ oil with 1.3% sulfated ash (30% more ash content) may result in the need for DPF cleaning or exchange 20 to 30% sooner than would normally be required.

EPA07 ATS Operation

The "exhaust system" in EPA07-compliant vehicles is called the aftertreatment system (ATS). The ATS varies according to engine manufacturer and vehicle configuration, but instead of a muffler, an aftertreatment system has a device that outwardly resembles a muffler, called the aftertreatment device (ATD).

IMPORTANT: See your engine operation manual for complete details and operation of the aftertreatment system.

Inside the aftertreatment system, the exhaust first passes over the diesel oxidation catalyst (DOC), then through the diesel particulate filter (DPF) which traps soot particles. If the exhaust temperature is high enough, the trapped soot is reduced to ash in a process called passive regeneration (passive regen). **Passive regeneration** occurs as the vehicle is driven normally under load; the driver is not even aware that it is happening. The harder an EPA07 engine works, the better it disposes of soot, because the exhaust heat gets high enough to burn the soot to ash. Over the course of a workday, however, passive regen cannot always keep the ATD filter clean, so the filter must undergo **active regeneration (active regen)**. In active regen, extra fuel is injected into the exhaust stream to superheat the soot trapped in the DPF and turn it to ash. Active regen happens only when the vehicle is moving above a certain speed, determined by the engine manufacturer. Consult your engine manufacturers' documentation for details. Both active and passive regen happen automatically, without driver input.

When operating conditions do not allow at-speed active or passive regen, the vehicle may require a driver-activated **parked regeneration (parked regen)** with the vehicle stationary. Completing a parked regen takes 20 minutes to an hour, depending on ambient conditions.

The ATS warning lamps in the driver message center alert the driver of a regen in progress, high exhaust temperatures, or the need to initiate a regen. See **Fig. 7.1** and **Fig. 7.2**.

The engine warning lamps work alongside the ATS warning lamps to indicate the severity of the warning; a steadily illuminated yellow malfunction indicator lamp (MIL) indicates an engine fault that affects the emissions, a check engine lamp indicates that an engine derate may occur, a stop engine lamp indicates that an engine shutdown will occur. See **Fig. 7.3**.

A reference card is included with the driver's documentation package initially in the glove box, that explains the ATS warnings, and the actions required to

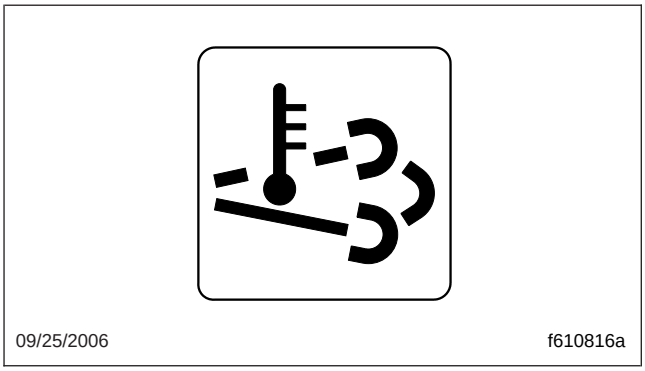


Fig. 7.1, High Exhaust System Temperature (HEST) Lamp

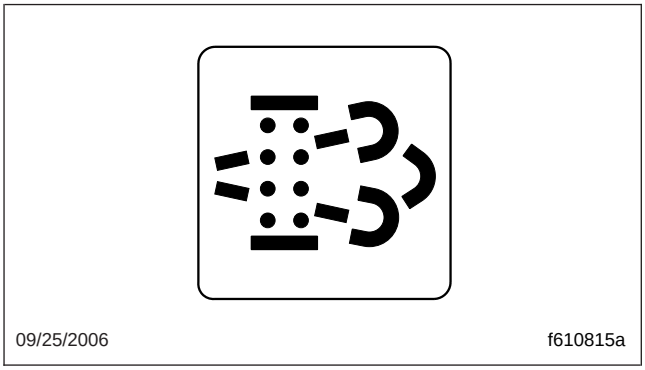
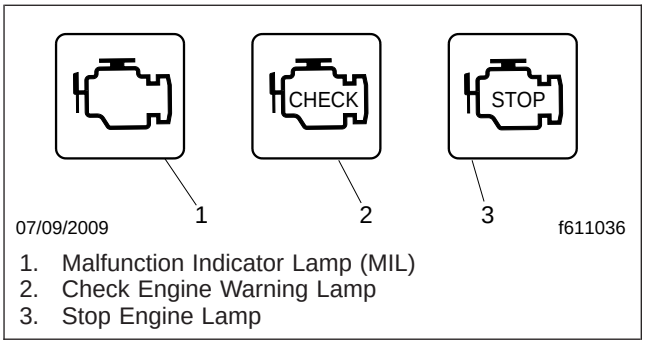


Fig. 7.2, Diesel Particulate Filter (DPF) Status Lamp



1. Malfunction Indicator Lamp (MIL)
2. Check Engine Warning Lamp
3. Stop Engine Lamp

Fig. 7.3, Engine Lamps

avoid automatic engine protection sequences. See **Fig. 7.4**.

A slow (10-second) flashing of the high exhaust system temperature (HEST) lamp indicates that a parked regen is in progress. The engine high-idle speed is controlled by the engine software, not the vehicle operator.

A steadily illuminated HEST lamp alerts the operator of high exhaust temperature during the regen process if the vehicle speed is below 5 mph (8 km/h), or during a parked regen.

NOTE: The HEST lamp does not signify the need for any kind of vehicle or engine service; it alerts the vehicle operator of high exhaust temperatures.

⚠ WARNING

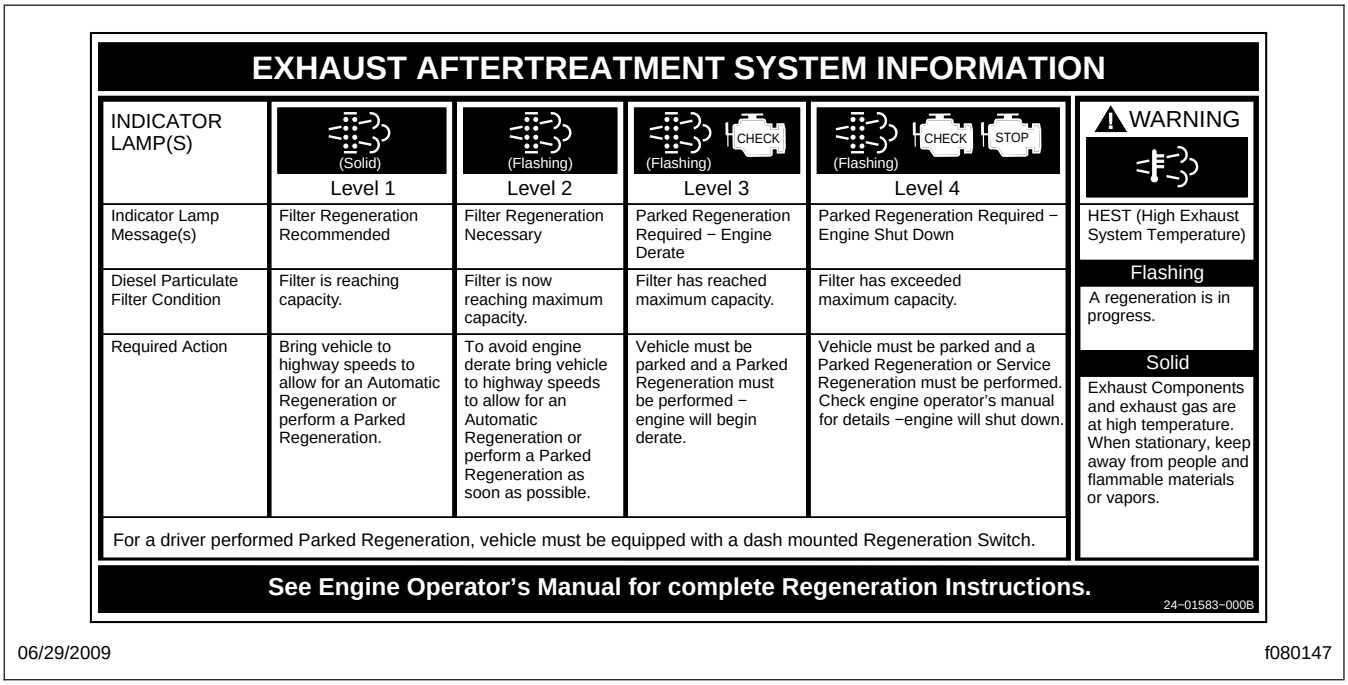
Active regeneration can occur automatically any time the vehicle is moving. The exhaust gas temperature could reach 1500°F (800°C), which is hot enough to ignite or melt common materials, and to burn people. The exhaust can remain hot after the vehicle has stopped moving.

A steadily illuminated yellow diesel particulate filter (DPF) lamp indicates that a filter regen is recommended because the filter is reaching capacity. Bring the vehicle to highway speeds to allow for an automatic regen, or perform a parked regen.

A flashing yellow DPF lamp indicates that a DPF regen is necessary because the filter is reaching maximum capacity. To avoid engine derate, bring the vehicle to highway speeds to allow for an automatic regen, or perform a parked regen as soon as possible.

A flashing yellow DPF lamp with a steadily illuminated yellow Check Engine lamp, indicates that a parked regen must be performed because the filter has reached maximum capacity. The vehicle must be parked, and a parked regen must be performed or the engine will begin derate.

A flashing yellow DPF lamp with a steadily illuminated yellow Check Engine lamp, and a steadily illuminated red Stop Engine lamp, indicates that a parked regen is required, or the engine will shut down because the filter has exceeded maximum capacity. The vehicle must be parked, and a parked regen or service regen must be performed. Check your engine operation manual for details.



EXHAUST AFTERTREATMENT SYSTEM INFORMATION

INDICATOR LAMP(S)	(Solid)	(Flashing)	(Flashing) CHECK	(Flashing) CHECK STOP
	Level 1	Level 2	Level 3	Level 4
Indicator Lamp Message(s)	Filter Regeneration Recommended	Filter Regeneration Necessary	Parked Regeneration Required − Engine Derate	Parked Regeneration Required − Engine Shut Down
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine derate bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration as soon as possible.	Vehicle must be parked and a Parked Regeneration must be performed − engine will begin derate.	Vehicle must be parked and a Parked Regeneration or Service Regeneration must be performed. Check engine operator's manual for details −engine will shut down.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch.				

WARNING

HEST (High Exhaust System Temperature)

Flashing

A regeneration is in progress.

Solid

Exhaust Components and exhaust gas are at high temperature. When stationary, keep away from people and flammable materials or vapors.

See Engine Operator's Manual for complete Regeneration Instructions.

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Fig. 7.4, Exhaust-Aftertreatment Warnings Reference Card

The regen switch, located on the dash, is used to initiate a parked regen of the aftertreatment device. The regen switch can start a parked regen only after the engine software calls for it, and the DPF light is illuminated. The regen switch cannot initiate a regen otherwise. See **Fig. 7.5.**

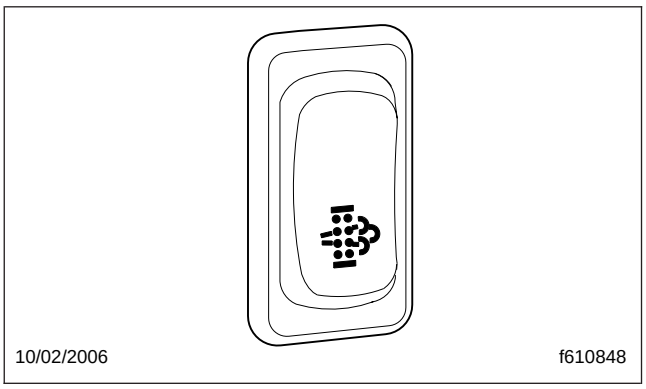

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Fig. 7.5, Regen Switch

A regen inhibit switch allows additional control over the aftertreatment regen process. When activated, the inhibit switch will stop a regen cycle in progress, and prevent the start of a regen cycle until the switch is no longer active. See **Fig. 7.6.**

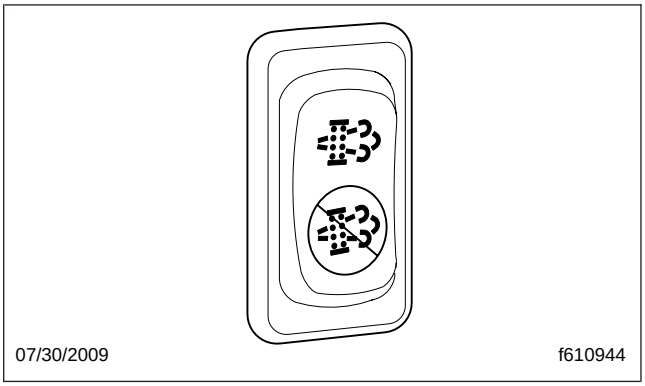

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Fig. 7.6, Regen Inhibit Switch

Parked Regen

DANGER

During parked regeneration, exhaust temperatures are very high, and could cause a fire, heat damage to objects or materials, or personal injury to persons near the exhaust outlet.

Before initiating a parked regeneration, make certain the exhaust outlets are directed away from

structures, trees, vegetation, flammable materials, and anything else that may be damaged or injured by prolonged exposure to high heat.

To initiate a parked regen, perform the following steps.

1. Park the vehicle away from all combustible and flammable materials. Chock the tires. Start and warm the engine until the coolant temperature is at least 150°F (66°C).
2. Set the parking brake. If the parking brake was already set, you must release it, then set it again.

   For manual transmissions, fully depress the clutch pedal, put the transmission in neutral, then release the pedal.

   If the vehicle has a two-pedal automated transmission, shift it into gear, then back to neutral.

NOTICE

The driver must remain with the vehicle during the entire regen cycle

3. Press and hold the regen switch for 4 seconds. The engine will increase rpm and initiate the regen process.
4. After the parked regen has run for 20 to 40 minutes, the regen cycle is completed. The engine idle speed will drop to normal, and the vehicle may be driven normally. The HEST lamp may be illuminated, but will go out when the vehicle speed exceeds 5 mph (8 km/h), or the system has cooled to normal operating temperature.
5. To stop a parked regen at any time during the process, engage the clutch, brake, or throttle pedal, or turn off the engine.

Diesel Particulate Filter Maintenance

When diesel particulate filter servicing is needed, it must be performed by an authorized technician, and a record must be maintained for warranty purposes. The record must include:

- date of cleaning or replacement;
- vehicle mileage;
- particulate filter part number and serial number.

Detroit Diesel Heavy-Duty Engine (DD13/15)

IMPORTANT: Always refer to your engine operator's manual, supplied with the vehicle, for complete details of engine operation.

DDEC VI

Because the DDEC VI system is electronic, vehicle battery power must be available to operate the computer. The system operates at 12 volts, however, in the event of a power supply malfunction, the system will continue to operate at reduced voltage. When this occurs, the amber warning lamp (Check Engine) will come on. The engine will operate only at reduced rpm. When the battery reaches a point where the Motor Control Module (MCM) hasn't enough power to function, the engine will shut down.

Besides the engine and its related sensors, the DDEC VI system has two control modules:

- a Motor Control Module (MCM) located on the engine;
- a Common Powertrain Controller (CPC) located in the vehicle cab.

The two control units are connected by a proprietary datalink, through which all necessary data and information is exchanged. The CPC broadcasts information on the J1587 and J1939 datalinks, where it is read by the diagnostic tool. The MCM monitors both the engine and datalink. When a malfunction is detected, the system selects an appropriate response; for example the emergency-running mode may be activated.

Motor Control Module (MCM)

The MCM is located on the left-hand side of the engine. See **Fig. 7.7**.

The MCM processes the data received from the CPC; for example, the position of the accelerator pedal, engine brake, etc. This data is evaluated together with the data from the sensors on the engine, such as coolant and fuel temperature, and oil and charge pressure. The data is then compared to the characteristic maps stored in the MCM. From this data, the quantity and timing of fuel injection are calculated.

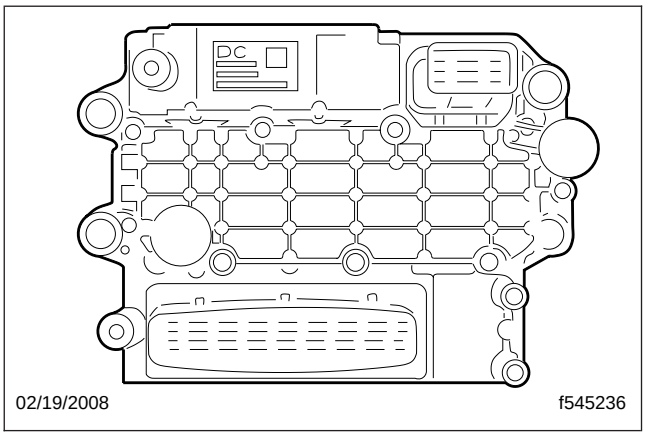


Fig. 7.7, Motor Control Module (MCM)

Common Powertrain Controller (CPC)

The CPC is located in the vehicle cab. See **Fig. 7.8**. The CPC communicates with the MCM, over the J1939 datalink. Data for specific applications is stored in the CPC. These include idle speed, maximum running speed, and speed limitation.

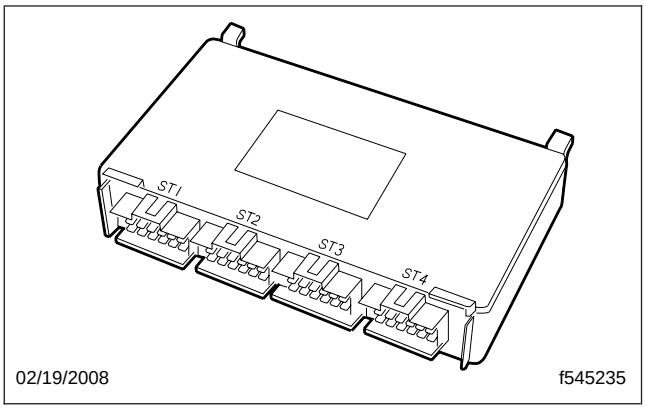


Fig. 7.8, Common Powertrain Controller (CPC)

The CPC receives data from the following sources:

- the operator (accelerator pedal position, engine brake switch, etc.)
- other electronic control units (for example, the antilock brake system)
- the MCM (oil pressure, coolant temperature, etc.)

California Engine Idle Limiting

In order to meet the California engine idle limiting standard, an engine idle shutdown feature has been built into the DDEC VI engine control strategy. When the California engine idle limiting feature is enabled, the engine will generally shut down after five minutes of continuous idling when the transmission is in neutral or park, and the parking brake is set, or after fifteen minutes when the transmission is in neutral or park, and the parking brake is not set.

Activating or momentarily changing the position of the service-brake pedal, the clutch pedal, stop-engine override switch, the accelerator pedal, or parking brake status, during the final 30 seconds before a shutdown would otherwise occur, will prevent the engine from shutting down, and will reset the shutdown timer. After an automatic shutdown, the engine may be restarted and operated normally.

If a parked regen of the aftertreatment system is initiated, it will override the five-minute idle shutdown. The HEST lamp will flash every ten seconds, indicating a regeneration is in progress, and the driver is not controlling the engine idle.

The automatic shutdown feature is generally disabled on engines certified by the U.S. EPA for use outside California.

Data Recording Capability

DDEC VI contains the ability to extract detailed data on the engine use and performance, using DDEC Reports software. This data, known as DDEC Data, is stored in the CPC and contains information on engine performance (such as fuel economy, idle time, time in top gear), and critical incidents (such as detailed diagnostic data records and hard braking events). DDEC Data can be downloaded using DDEC Reports software to produce reports. See the *Detroit Diesel DD15 Engine Operator's Guide* for complete details.

Flashing Malfunction Codes

All malfunction codes are four digits. The malfunction code recorded in the computer memory will remain until it is erased by a technician. The flashing malfunction code can also be obtained by the operator. See the *Detroit Diesel DD15 Engine Operator's Guide* for complete details.

DDEC VI Driving Tips

Accelerating the Vehicle

The accelerator pedal was designed to communicate "percentage" of accelerator pedal travel to the engine MCM. A throttle characteristic you may need time to get used to, is the DDEC limiting speed governor. This allows the driver to command total engine response between idle and rated speed, such as accelerating at half throttle—an advantage when driving under slippery conditions. To obtain 100 percent fueling at any speed, the accelerator pedal must be depressed to the fully pressed position.

Shifting

Depending on your transmission model, the gear split may vary from 400 to 500 rpm. The electronic governor provides almost no overrun capability; if the transmission is downshifted too early, you will experience a temporary loss of pulling power until the engine speed falls below rated speed. In general, when using a 9-speed transmission, you should always downshift between 1000 and 1100 rpm. This is true even on steep grades with heavy loads. When using an 18-, 15-, or 13-speed transmission, you will need to downshift at an rpm that allows less than rated rpm, before throttle application in the next gear down. You may want to limit engine speed to 1900 rpm in all gears.

The Detroit Diesel HD engines provide horsepower through 2100 rpm, but fuel economy is not as efficient above 1800 rpm. If you decide to drive at lower rpm for improved fuel economy, don't let different engine noises throw you off guard. The Detroit Diesel HD engine sounds quiet at 1400 rpm, almost as if it had quit pulling. If you had a boost gauge to look at while driving, you would notice the turbocharger maintaining steady intake manifold pressure, even as rpm falls. Depending on the air intake arrangement, you may also hear a "chuffing" sound as the engine starts to pull hard at lower rpm. This is normal, and caused by the velocity changes of the air flow within the air intake plumbing. Electronic engines can actually deliver more fuel at lower engine speeds than at rated speed.

The Detroit Diesel HD engine has been designed for a very quiet operation, but the air flow may be noticeable to the tuned attentive ear. The turbocharger operates at higher boost pressure, forcing exhaust to flow through the exhaust gas recirculation plumbing.

In some situations the driver may believe they have experienced a charge air cooler system leak. Even while connecting trailer lights and air hoses, the driver may hear a different tone (exhaust and under hood with the engine idling). If equipped with a turbo boost gauge, the driver may occasionally note the intake manifold pressure exceeds 35 psi (241 kPa).

Idling

The common belief that idling a diesel engine causes no engine damage is wrong. Idling produces sulfuric acid that is absorbed by the lubricating oil and eats into bearings, rings, valve stems, and engine surfaces. If you must idle the engine for cab heat or cooling, the high idle function of the cruise control switches should be used. An idle speed of 900 rpm should be enough to provide cab heat in above freezing ambient temperatures.

Cold-Weather Operation

Precautions must be taken during cold weather to protect your engine. Special cold-weather handling is required for fuel, engine oil, coolant, and batteries. The engine does not require starting aids down to 50°F (10°C). A grid heater is included for temperatures between 50°F (10°C) and –4°F (–20°C). Temperatures below –4°F (–20°C), will require a grid heater, block heater, and oil pan heater.

NOTICE

NEVER use ether as a starting aid on a DD HD engine. Doing so will result in injector damage.

A winterfront may be used to improve cab heating. At least 25 percent of the grill opening should remain open in sectioned stripes that run perpendicular to the charge air cooler tube flow direction. This assures even cooling across each tube, and reduces header-to-tube stress and possible failure. Winterfronts should only be used when the ambient temperature remains below 10°F (–12°C).

Driving on Flat, Dry Pavement

Use the following guidelines when driving on flat, dry pavement.

- If driving on open stretches with a light load, place the progressive braking switch in the LOW position.

- If you find you are still using the service brakes, move the switch to a higher position until you do not need to use the service brakes to slow the vehicle.
- If you are carrying a heavier load and road traction is good, move the progressive braking switch to the HIGH position.
- Check your progressive braking switch often for proper position, since road conditions can change quickly. Never skip a step when operating the progressive braking switch. Always go from OFF to LOW, and then to a higher position.

Descending a Long, Steep Grade

Control speed is the constant speed at which the forces pushing the vehicle forward on a grade are equal to the forces holding it back, without using the vehicle service brakes. In other words, this is the speed the vehicle will maintain without using the service brakes or throttle.

⚠ WARNING

Do not over apply the vehicle service brakes when descending a long, steep grade. Excessive use of the vehicle brakes will cause them to heat up, reducing their stopping ability. This condition, referred to as "brake fade", may result in loss of braking, which could lead to loss of control of the vehicle, resulting in personal injury or property damage.

Use the following guidelines when descending a long, steep grade.

- Before beginning the descent, determine if your engine brake system is operating properly by lifting your foot briefly off the accelerator pedal. You should feel the system activate.
- Check the progressive braking switch often for proper position, since road conditions can change quickly. Never skip a step when operating the progressive braking switch. Always go from OFF to LOW and then to a higher position when on slippery roads.
- Do not exceed the safe control speed of your vehicle. Example: You could descend a 6 percent grade, under control at 10 mph (16 km/h) without an engine brake, but at 25 mph (40 km/h) it requires an engine brake. You could not descend that same hill at 50 mph (80 km/h) and remain under control. Know how much slowing power your engine brake can provide before descending hills, and do not exceed a safe control speed.

Driving on Wet or Slippery Pavement

⚠ WARNING

To avoid injury from loss of vehicle control, do not activate the engine brake system under the following conditions:

- **on wet or slippery pavement**
- **when driving without a trailer (bobtailing) or pulling an empty trailer**
- **if the tractor drive wheels begin to lock, or there is fishtail motion after the engine brake is activated**

NOTE: On single trailers or combinations, a light air application of the trailer brakes may be desirable to help keep the trailer stretched out. Follow the manufacturer's recommended operating procedure when using the trailer brakes.

On wet or slippery pavement, start with the master switch in the OFF position and use the gear you would normally use under these conditions. If the vehicle is maintaining traction, place the selective braking switch in the LOW position and turn ON the engine brake system. If the drive wheels are maintaining traction and you desire greater slowing power, move the braking switch to the next higher position. However, if the tractor drive-wheels begin to lock, or there is a fishtail motion, turn the engine brake system OFF immediately and do not activate it until road conditions improve.

Check your progressive engine braking switch often for proper position, since road conditions can change quickly. Never skip a step when operating the progressive braking system. Always go from OFF to LOW and then to a higher position.

Engine Starting—CAT, Cummins, DDE S60, M-B

Normal Starting

Whenever you start an engine, watch for any signs of engine problems. If the engine vibrates, misfires, or makes unusual noises, turn the engine off as soon as possible and determine the cause of the problem. Frequently, engine damage may be avoided by a quick response to early indications of problems.

NOTICE

When starting a vehicle equipped with a manual transmission and clutch lockout switch, the clutch pedal must be fully depressed during the entire start sequence. Failure to do so can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

If a vehicle does not start on the first attempt, make sure that the engine has completely stopped rotating before reapplying the starter switch. Failure to do so can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

Moving a vehicle with the starter and/or using the starter to bump the engine for maintenance procedures is strictly prohibited. Use of these methods to bump the engine over or move the vehicle can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

IMPORTANT: The starter cannot be used for priming the fuel system. Priming is done by operating the manual hand-priming pump located on the fuel filter module, or connecting an electric-priming pump to the priming port on the fuel filter module. See the engine operation manual for complete instructions.

Prestart

NOTE: These prestart steps apply to all engines.

1. Perform the engine pretrip inspection and daily maintenance checks in **Chapter 11**.
2. Apply the parking brake.

NOTE: On vehicles equipped with a neutral start switch, the transmission must be in neutral before the engine can be started. For air start systems, check the air supply before starting the engine. There must be 100 psi (689 kPa) of air pressure available.

3. For manual transmissions, place the transmission in neutral and disengage the clutch.

   For automatic transmissions, make sure the transmission shift control is in neutral or park.

Starting Precautions

NOTICE

Do not crank the engine for more than 30 seconds at a time. Wait two minutes after each try to allow the starter to cool. Failure to do so could cause starter damage.

NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

WARNING

Never pour fuel or other flammable liquid into the air inlet opening in the air intake in an attempt to start the vehicle. This could result in a flash fire causing serious personal injury or property damage.

WARNING

Starting fluid is highly flammable and explosive. It can cause serious injury or death if improperly handled. Do not smoke where starting fluid is in use. Keep sparks, flames, and arc welding equipment away from starting fluid.

NOTICE

Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until minimum engine idle oil pressure registers on the gauge. Failure to do so could damage the turbocharger.

Caterpillar

NOTE: Perform the steps in "Prestart" first.

1. Turn the ignition switch to the ON position (**Fig. 7.9**). All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

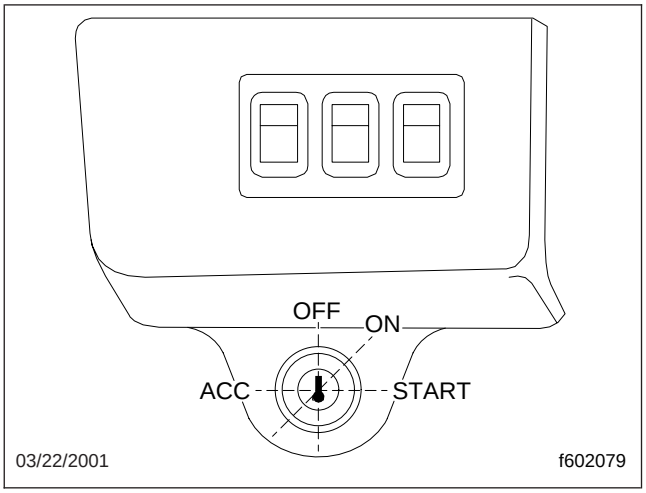


Fig. 7.9, Ignition Switch Positions

NOTE: The engine electronics supply the correct amount of fuel for starting the engine. Pedal pressure is unnecessary.

2. Turn the ignition switch to the START position. Do not press down on the throttle pedal. Release the switch the moment the engine starts.

   2.1 If the engine does not start after 30 seconds of cranking, turn the ignition switch OFF.

   NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

   2.2 Wait two minutes to allow the starter motor to cool. Turn the ignition switch back to the ON position and try again to start the engine.

   2.3 As soon as the engine starts, release the ignition switch, allowing the engine to run at a slow idle.

NOTICE

If the oil pressure is less than 5 psi (35 kPa), shut down the engine immediately to prevent serious damage. If the vehicle is equipped with an automatic shutdown system, the engine will shut down after 30 seconds.

3. Run Caterpillar C–10/C–12/C–15/C–16 engines at low load and speed once the engine oil pressure has reached 10 to 20 psi (69 to 138 kPa). Run a Caterpillar 3406E engine at low load and speed once the engine oil pressure has reached 18 psi (124 kPa).

4. Operate the engine at full load, when the engine has reached the normal operating temperature of 189°F (87°C).

Cummins

Perform the steps in "Prestart" first.

1. Turn the ignition switch to the ON position (**Fig. 7.9**). All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

2. Turn the ignition switch to the START position. After the engine starts, release the key.

NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

3. Bring the engine up to operating speed gradually as it warms up and develops stable oil pressure.

NOTE: When the engine is started, it takes a short time to build up a lubricating oil film between the shafts and bearings, and between the pistons and liners. The oil pressure gauge indicates any drop in lubricating oil pressure within 15 seconds of engine start-up.

4. If a minimum engine oil pressure at idle of 10 psi (69 kPa) does not register within 15 seconds, shut down the engine.

NOTICE

Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until minimum engine idle oil pressure registers on the gauge. Failure to do so could damage the turbocharger.

5. Idle the engine for three to five minutes at 1000 rpm before operating the engine under load.

DDE S60

NOTE: Perform the steps in "Prestart" first.

1. Turn the ignition switch to the ON position (see **Fig. 7.9**). All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.
2. When all the indicators go out, turn the ignition switch to the START position. Without touching the throttle pedal, start the engine. If the engine won't start within 15 seconds, release the ignition switch and allow the starter motor to cool.

IMPORTANT: If the engine won't start, check the main engine power fuses. The fuses are located along the main engine electrical harness, on the left frame rail near the batteries. If the fuses are blown, replace the fuses. Be sure to find the cause of the blown fuses as soon as possible.

NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

⚠ WARNING

Never pour fuel or other flammable liquid into the air inlet opening in the air intake in an attempt to start the vehicle. This could result in a flash fire causing serious personal injury or property damage.

3. Check the oil pressure gauge immediately after starting the engine.
4. If no pressure registers within 10 to 15 seconds or the ENGINE PROTECT indicator comes on, shut down the engine and check the lubricating oil system.

NOTICE

Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until minimum engine idle oil pressure registers on the gauge. Failure to do so could damage the turbocharger.

5. Idle the engine for about five minutes at 1000 rpm before operating the engine under load.

Mercedes-Benz

NOTE: Performs the steps in "Prestart" first.

1. Turn the ignition switch to the ON position (**Fig. 7.9**). All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

IMPORTANT: On vehicles equipped with an intake air preheater, the INTAKE HEATER indicator stays on for a minimum of two seconds regardless of coolant temperature. Wait until the INTAKE HEATER indicator goes out before attempting to start the engine.

2. Turn the ignition switch to the START position. Without touching the throttle pedal, start the engine.

NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

3. Idle the engine for one to three minutes at 600 to 850 rpm before operating the engine under load.
4. Check the oil pressure gauge for any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system. Minimum oil pressure at idle is 7 psi (50 kPa).

NOTICE

Do not rev the engine if the oil pressure gauge indicates no oil pressure. Shut down the engine if no oil pressure appears within approximately

ten seconds. Check to determine the cause of the problem. Operating the engine with no oil pressure will damage the engine.

Cold-Weather Starting

Electronic engines do not normally require special starting aids. At low temperatures, oil pan heaters or water jacket heaters are sometimes used to assist in starting.

Older vehicles with non-electronic engines may be equipped with an automatic ether start system.

NOTICE

Never attempt to start an electronic engine using ether or any other starting fluid. Serious engine damage could result.

⚠ WARNING

If using a cold-weather-start system, be sure to follow the manufacturer's instructions regarding its use, handling, and storage. Many starting fluids are in capsules or pressure cans, and improper usage can be dangerous.

Do not attempt to use any type of vapor-compound start system near heat or open flame. Engine damage due to an explosion or fire in the intake manifold could result.

Do not breathe the ether fumes; doing so could result in personal injury.

Caterpillar

Turn the ignition switch to the ON position (**Fig. 7.9**).

If the engine doesn't start after 30 seconds of cranking, turn the key to the OFF position and wait two minutes; then repeat the starting procedure.

If the coolant temperature is less than 64°F (18°C), the engine will start up in the cold-start strategy. This reduces the amount of fuel available to the injectors, advances the timing, and controls white smoke emissions. The engine remains in the cold-start strategy until the coolant temperature rises above 64°F (18°C), or until it has been running for 12 minutes.

IMPORTANT: Do not move the vehicle when it is in the cold-start strategy. Power will be noticeably reduced.

After a cold engine start of less than 64°F (18°C), Caterpillar electronic engines automatically idle at 800 rpm (for C–10 and C–12 engines), or 600 rpm (for 3406E, C–15, and C–16 engines). These electronic engine systems will adjust the idle speed to 700 to 750 rpm when the engine is warm enough to drive the vehicle.

Cummins

The cold-start system approved for use on Cummins engines has been based upon starting aid capabilities to –25°F (–32°C). For more information, see the Cummins *Operation and Maintenance Manual*.

Turn the ignition switch to the ON position (**Fig. 7.9**).

If the engine doesn't start after 30 seconds of cranking, turn the key to the OFF position and wait two minutes; then repeat the starting procedure.

Run the engine slightly above idle until oil pressure shows on the gauge. If oil pressure doesn't show on the gauge within 30 seconds of starting, turn the key to the OFF position and wait one minute; then repeat the starting procedure.

DDE S60

The engine may require the use of a cold-weather starting aid if the outside temperature falls below 40°F (4°C).

Turn the ignition switch to the ON position and start the engine.

If the engine doesn't start after 30 seconds of cranking, turn the key to the OFF position and wait two minutes; then repeat the starting procedure.

Run the engine slightly above idle until oil pressure shows on the gauge. If oil pressure doesn't show on the gauge within 30 seconds of starting, turn the key to the off position and wait one minute; then repeat the starting procedure.

Mercedes-Benz

The intake air preheater is activated by turning the ignition switch to the on position (**Fig. 7.9**). If the engine is at normal temperature, the INTAKE HEATER indicator goes out after two seconds.

If the temperature is low enough to require the heater, the INTAKE HEATER indicator stays on while the intake air preheater warms up. After the indicator goes out, start the engine. If the engine doesn't start

after about 30 seconds of cranking, turn the key to the off position and wait two minutes; then repeat the starting procedure.

NOTE: If the engine doesn't start on the second try, wait at least five minutes before using the intake air preheater again.

Starting After Extended Shutdown or Oil Change

An engine in storage for an extended period of time (over winter, for example) may accumulate water in the oil pan. Oil diluted by water cannot provide adequate bearing protection at start-up. For this reason, change the engine oil and filters after extended storage.

Perform the following steps after an oil change or after the engine has been shut down for more than three days.

1. Make sure the transmission is filled with the correct type of fluid, as recommended by the transmission manufacturer.
2. Make sure the fuel tank is full. If air has entered the fuel system, prime the fuel system, using the engine manufacturer's instructions.
3. If the engine is equipped with a fuel/water separator, drain off any accumulated water.
4. Check the drive belts to make sure they are in good condition and properly adjusted. Replace any drive belts that are cracked, worn, or glazed.
5. Check the turbocharger for signs of oil or exhaust leaks. Correct any problems before starting the engine.
6. Check the engine mounting bolts for tightness. Retighten them if necessary.
7. Make sure the battery cable connections are clean and tight. Check that the batteries are charged.
8. Start the engine normally.

Engine Operation—CAT, Cummins, DDE S60, M-B

Each engine must pass a full-load operating test on a dynamometer before shipment, thereby eliminating the need for a break-in period. Before running the engine for the first time, follow the instructions in the engine manufacturer's operation manual specific to your engine.

Operating vehicles with diesel engines in areas where there are concentrated flammable vapors (such as diesel, gasoline, or propane fumes) can create a hazardous situation. These vapors can be drawn into the engine through the air intake and cause engine overspeed. Be especially cautious of low-lying or closed-in areas, and always check for signs that flammable vapors may be present.

⚠ DANGER

Do not operate the engine in an area where flammable vapors such as gasoline or diesel fumes are present. Shut down the engine when in an area where flammable liquids or gases are being handled. Failure to observe these precautions could result in serious injury or death.

Normal Operation, Caterpillar

The Caterpillar C–10, C–12, and 3406E electronic engines use a computer (electronic control module) to automatically control engine timing and fuel injection. The electronic features of these engines include an electronic governor, fuel-to-air ratio control, programmable engine ratings, injection-timing control, fault analysis and recording, and a datalink used for programming the electronic-control module and troubleshooting the system.

Proper operation and maintenance are key factors in obtaining the maximum life and economy of a vehicle engine. Refer to the instructions in the Caterpillar *Operation and Maintenance Management Manual* and this manual, for trouble-free, economical engine operation.

When starting out, operate the engine at low load. After normal oil pressure is reached and the temperature gauge begins to move, the engine may be operated at full load.

Caterpillar electronic engines automatically idle at 900 to 1000 rpm for the correct warm up time after a cold engine start (less than 40°F [5°C]). These electronic engine systems will reduce the idle speed to 600 rpm when the engine is warm enough to drive the truck.

IMPORTANT: Fuel heaters used on vehicles with Caterpillar electronic engines could cause

excessive fuel temperatures that affect engine performance and operation of the electronic engine controls. If a fuel heater is used, make sure it has thermostatic controls. If the fuel heater has a timer, set the timer to activate only for a limited period of time before the engine starts. Make sure the fuel heater is used only for starting the engine.

Select a gear that allows a smooth, easy start without increasing engine speed above low idle or slipping the clutch. Engage the clutch smoothly. Jerky starts waste fuel and put stress on the drivetrain.

It is not necessary to accelerate Caterpillar electronic engines to governed speed in the lower gears to get the vehicle moving, except in a high power demand situation such as starting on a grade.

Continue to upshift until cruising speed is reached. Use only the rpm needed to make an upshift into the next gear. The engine speed needed to make an upshift increases as the truck speed increases or if upshifts are made on uphill grades. If the truck can be operated in a higher gear after reaching the desired speed, select the highest gear available that will pull the load. Experience with your truck will show you what rpm is needed to make upshifts under various conditions. This "progressive shifting" technique will lower fuel costs because the engine will be operating at the lowest rpm needed to pull the load.

Caterpillar electronic engines can be programmed to limit engine rpm while the truck is operated in the lower and higher gears. This feature assists the driver in following "progressive shifting" techniques.

On uphill grades, begin downshifting when the engine rpm falls to 1200 rpm for C–10, C–12, and 3406E electronic engines. Fuel economy will be best if you let the engine lug back to around this speed before you downshift. Downshift until a gear is reached in which the engine will pull the load. Let the engine lug down if you can make it to the top of a hill without downshifting.

IMPORTANT: Do not let C–10, C–12, and 3406E electronic engines exceed 2300 rpm (2100 rpm if equipped with an exhaust brake).

On a downhill grade, do not coast or put the transmission in neutral. Select the correct gear that does not allow the engine to exceed its maximum speed. Use the brakes to limit the truck speed.

A simple rule to follow is to select the same gear (or one gear lower) that would be needed to go up the grade.

As with any engine, prolonged idling of Caterpillar engines is not recommended. An idling engine wastes fuel and if left unattended, is also unsafe.

Caterpillar engines can be programmed to shut off automatically after a specified idling time. The vehicle transmission must be in neutral and the parking brake must be set for the automatic shutoff option to work.

Normal Operation, Cummins

Cummins CELECT Plus is an electronic fuel control system. These electronic engines are controlled by a microprocessor-based computer. This computer controls specific engine and vehicle speed modes of operation to maximize vehicle fuel economy and performance.

Cummins diesel engines have been built by Cummins to comply with the requirements of the Federal (U.S.) Clean Air Act. Once the engine is placed in service, the responsibility for meeting both state and local regulations is with the owner/operator. Good operating practices, regular maintenance, and proper adjustments are factors which will help to stay within the regulations. Proper maintenance of the engine, which is the responsibility of the owner/operator, is essential to keep the emission levels low.

Cummins diesel engines produce high horsepower and peak torque characteristics at lower rpm. Because of this, it is not necessary to keep the engine "wound up" to deliver the required horsepower at the wheels. These characteristics may also result in less shifting and make shifting at lower rpm (toward peak torque) more practical.

Depending on the vehicle gearing, the posted speed limit can sometimes allow operation in either of the top two gears; however, for improved operating efficiency (fuel economy and engine life), operate in the top gear at reduced rpm, rather than in the next lower gear at the maximum rpm.

Cruise at partial throttle whenever road conditions and speed requirements permit. This driving technique permits operating within the most economical power range of the engine.

When approaching a hill, open the throttle smoothly to start the upgrade at full power, then shift down as

desired to maintain the maximum vehicle speed. The higher torque of Cummins engines may permit topping some grades without shifting.

Cummins engines are designed to operate over a wide speed range. More frequent shifting than necessary does not allow proper utilization of this flexibility. The driver who stays in top gear and uses the wider speed range will achieve the best fuel economy.

The Cummins diesel engine is effective as a brake on downhill grades, but care must be used not to overspeed the engine going downhill. The governor has no control over engine speed when it is being pushed by the loaded vehicle.

Never turn off the ignition switch while going downhill. With the engine still in gear, fuel pressure will build up against the shutdown valve and may prevent it from opening when the ignition key is turned on.

NOTICE

Engine overspeed (engine speed exceeds high idle, no-load rpm) can damage the engine. Use a combination of brakes and gears to keep the vehicle under control at all times and to keep the engine speed below the rated governed rpm.

Normal Operation, Detroit Diesel S60 (DDEC III)

The DDEC III system uses a computer that is programmed to automatically control engine timing and fuel injection, providing maximum engine performance and fuel economy.

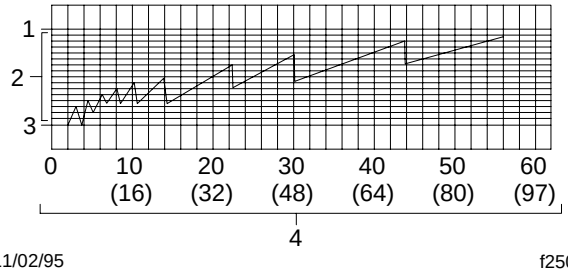
Individual driving habits can make a difference in the performance and economy of any engine. The recommendations below call attention to the techniques that can be employed to save fuel and extend the operating efficiency and life of a new Detroit Diesel engine for the longest possible time.

All engines have an operating range in which the engine performs most efficiently. The operating range extends from maximum torque rpm at the low end to engine rated speed at the high end. Detroit Diesel engines deliver best fuel economy when operated in the low- and mid-speed segments of the efficiency range and produce maximum horsepower at rated speed, which is also the recommended maximum speed of the engine.

It is seldom necessary to accelerate the engine to governed speed in the lower gears to get the vehicle moving, except in a high power demand situation such as starting on a grade.

To conserve fuel, start off in low gear and develop only the engine speed needed to get rolling. Then, increase engine speed gradually as upward gear shifting progresses.

As described by Detroit Diesel, this "progressive shifting" technique will get the vehicle up to the desired cruising speed while minimizing noise emission and maximizing fuel economy. A progressive shift pattern is illustrated in **Fig. 7.10**.



1. Governed RPM
2. Engine RPM
3. Idle RPM
4. Miles (Kilometers) Per Hour

Fig. 7.10, Progressive Shift Pattern

NOTE: A momentary hesitation in throttle response will occur when a vehicle with a turbocharged engine is started on a grade. *Do not* disengage the clutch. The rpm will recover, and the vehicle will accelerate up the grade.

For city driving, run in the highest gear possible and reduce engine speed. This enables you to operate at a safe speed for traffic conditions while using less fuel and reducing noise. Also, when slowing down for reduced speed zones, remain in your running gear and reduce engine rpm to stay within the speed limit. Avoid downshifting until you are ready to return to highway cruising speed.

For highway cruising, and for best fuel economy, run the engine at 80 to 90 percent of rated rpm to maintain highway speed. Engines with 1800 rpm ratings are exceptions and will provide fuel economy when run at their rated speed. Proper gear selection

should permit cruising in the economy range with no appreciable sacrifice in desired highway speed.

It is okay to operate below rated rpm at full throttle if you are satisfied with the way the vehicle performs. However, there are times when hilly terrain, high winds, or other conditions make it impractical to operate without reserve power. Such conditions are better met if the vehicle is operated in a lower gear with reserve power available for changes in terrain, wind, etc.

The proper use of gears will shorten time on hills and minimize the amount of shifting. When starting up a hill, gradually depress the accelerator pedal all the way and keep it there as the vehicle moves up the grade. If the engine continues to maintain a satisfactory road speed, remain in that gear for the entire grade.

If the hill causes a steady decline in engine rpm, downshift as required until the engine can maintain a stable uphill speed. Make full use of each gear before going to a lower gear. By remaining in a gear until arriving at the speed of the next lower gear, the vehicle will top the grade in the best possible time on less fuel and fewer shifts.

Because of their constant torque over a wide speed range, Detroit Diesel engines can be operated at full throttle at lower rpm than other engines. This offers benefits in fuel economy and engine life. And more than likely it will be possible to top most grades without downshifting.

When the vehicle starts into a grade, allow the engine to lug down to maximum torque rpm before downshifting. Downshift, if required, at maximum torque rpm also or at the predetermined road speed for the next lower gear.

Do not be afraid to lug the engine down. It has more than enough torque at low rpm to keep a loaded vehicle moving against a grade and it won't harm the engine.

The driver who is not familiar with the vehicle's shift points can greatly improve driving skill by learning them for all gears. By knowing rather than guessing where the shift points are it is possible to avoid overspeeding the engine by downshifting too soon or missing the full use of a gear by downshifting too late. The shift points of any vehicle can be determined by a simple road-test method. Run the vehicle and determine the maximum road speed possible in every gear at the engine governed full-load speed setting.

The top road speed possible in a gear would be the shift point for that gear. The results should be recorded in the proper order of shifting and displayed inside the cab.

NOTICE

Engine overspeed (engine speed exceeds high idle, no-load rpm) can damage the engine.

To slow the vehicle on downgrades and curves (using the engine), shift to a lower gear and allow the vehicle to decelerate in that gear. The engine provides maximum braking effect when running at the top end of the operating range, but it must not be allowed to exceed its full-load rated rpm. Continue to downshift as further reduction in vehicle speed is required. If the vehicle is above the allowable maximum speed of a lower gear, use the service brakes to slow the vehicle to an acceptable speed where the transmission may be downshifted safely. Again, the importance of knowing the shift points is demonstrated.

IMPORTANT: The engine governor has no control over engine rpm when the engine is being pushed by a loaded vehicle down a grade. Use service brakes and gears in combination on long grades to keep the vehicle speed under control and the engine rpm below full-load rated governed speed.

Essential information regarding the operation and care of Allison automatic transmissions is contained in the Allison *Driver's Handbook.* Applying the knowledge presented will not only make driving easier, but will give the maximum benefits from an Allison-equipped vehicle.

Maintenance literature is also available for drivers of Allison-equipped vehicles who desire trouble-free performance and maximum life from their equipment. These maintenance books are available from any authorized Detroit Diesel engine distributor.

As with all engines, prolonged idling of Detroit Diesel engines is not recommended. An idling engine wastes fuel and if left unattended, is also unsafe.

A Detroit Diesel Electronic Control (DDEC) engine can be equipped to shut off automatically after five minutes of idling. The vehicle transmission must be

in neutral and the parking brake must be set for the automatic shutoff option to work. To start the engine, follow the normal start-up procedure.

Engines equipped with DDEC will idle fast when cold. As the engine warms up to operating temperature, the idle speed will decrease. Warm the engine until idle speed is normal before operating the vehicle.

Normal Operation, Mercedes-Benz

While you are driving, watch for any signs of engine problems. If the engine overheats, uses excessive fuel or lubricating oil, vibrates, misfires, makes unusual noises, or shows an unusual loss of power, turn the engine off as soon as possible and determine the cause of the problem. Frequently, engine damage may be avoided by a quick response to early indications of problems.

1. Use the tachometer to determine when to shift. Follow the pattern on the shift lever when moving through the gears.
2. Depending on the vehicle gearing, the posted speed limit can sometimes allow operation in either of the top two gears; however, for improved operating efficiency (fuel economy and engine life), operate in the top gear at reduced rpm, rather than in the next lower gear at the maximum rpm.
3. Cruise at partial throttle whenever road conditions and speed requirements permit. This driving technique permits operating within the most economical power range of the engine.
4. Use lower gears in steep downhill driving. Normally, the gear used to descend a hill is the same gear used to climb a hill of the same grade.
5. Never allow the engine to exceed the rated speed. Use the exhaust brake and the optional constant-throttle brake, if installed, to lower engine rpm below the rated speed.
6. Never allow the engine to idle for more than 30 minutes. Excessive idling can cause oil to leak from the turbocharger.

NOTICE

Stop the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed the warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

NOTE: Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low that the fuel may not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and may result in stuck valves.

If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil, causing all moving parts of the engine to suffer from poor lubrication.

Cold-Weather Operation—CAT, Cummins, DDE S60, M-B

Satisfactory performance of a diesel engine operating in low ambient temperatures requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The lower the temperatures, the greater the amount of modification required; and yet with the modifications applied, the engines must still be capable of operation in warmer climates without extensive changes.

The following information is provided to engine owners, operators, and maintenance personnel on how the modifications can be applied to get satisfactory performance from their diesel engines.

There are three basic objectives:

- Reasonable starting characteristics followed by practical and dependable warm-up of the engine and equipment.
- A unit or installation which is as independent as possible from external influences.
- Modifications which maintain satisfactory operating temperatures with a minimum increase in maintenance of the equipment and accessories.

If satisfactory engine temperature is not maintained, higher maintenance cost will result due to increased engine wear. Special provisions to overcome low temperatures are definitely necessary, whereas a change to a warmer climate normally requires only a

minimum of revision. Most of the accessories should be designed in such a way that they can be disconnected so there is little effect on the engine when they are not in use.

IMPORTANT: If a winterfront is used on a vehicle with an electronic engine equipped with a charge air cooler, make sure that there are slit openings distributed across the face of the winterfront to allow airflow through the entire charge-air-cooler core. Do not use a winterfront with closed areas that block uniform air flow across all sections of the charge-air-cooler crossflow tubes. This will adversely affect the operation and durability of the charge air cooler.

On all engines, the following steps are necessary when operating in cold weather:

- Check for cracks in the battery cases, for corrosion of the terminals, and for tightness of the cable clamps at the terminals.
- Charge the batteries to full capacity. Replace any battery that is unable to hold full charge or is physically damaged.
- Check the alternator output.
- Check the condition and tension of the drive belts.

Caterpillar

If the engine is in good mechanical condition and the precautions necessary for cold-weather operation are taken, ordinary cold weather will not cause difficulty in starting or loss of efficiency.

If the engine does not start, prime the fuel system.

When the use of unblended No. 2 diesel fuel in winter cannot be avoided, install a thermostatically controlled fuel heater. Fuel heaters can prevent wax from clogging the fuel filters and formation of ice crystals from water in the fuel.

IMPORTANT: If a fuel heater is used, make sure it has thermostatic controls to prevent excessive heating of the fuel in warm weather. Excessive heating of fuel can cause a loss of engine power.

For cold weather operation, use the following guidelines:

- When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity. Refer to the Caterpillar *Operation and Maintenance Manual* for specifications.
- When the temperature is below freezing, use sufficient antifreeze solution in the cooling system to prevent freezing.
- During cold weather, give more attention to the condition of the batteries. Test them frequently to ensure sufficient power for starting. See **Group 15** of the *Century Class Trucks Workshop Manual* for detailed information.
- If so equipped, turn off the battery disconnect switch after the engine is shut down, to prevent battery discharge.

  For starting below 0°F (–18°C), an optional cold-weather starting assist is recommended. For temperatures below –10°F (–23°C), consult your Caterpillar dealer for recommendations.
- When customer parameters include cold-mode operation and the coolant temperature is below 82°F (28°C), the system puts the engine into cold mode. It adjusts the low idle to 600 rpm (for the 3406E, C–15, and C–16 engines) and 800 rpm (for the C–10 and C–12 engines). It also advances the timing, to reduce white smoke emissions and improve warm-up time. The system will keep the engine in cold mode until the coolant temperature rises above 82°F (28°C). After cold mode has been completed, operate the vehicle at low load and low rpm until the engine coolant reaches normal operating temperature of 189°F (87°C).
- Fuel cloud point is the temperature at which wax crystals become visible, which is generally above the pour point of the fuel. To keep the fuel filter elements from plugging with wax crystals, the cloud point should be no higher than the lowest ambient temperature at which the engine must start.

Cummins

The two most commonly used terms associated with preparation of equipment for low-temperature operation are "winterization" and "arctic specifications."

Winterization of the engine and/or components, so that starting and operating are possible in the lowest temperature to be encountered, requires:

- Proper lubrication with low-temperature lubricating oils.
- Protection from the low-temperature air. The metal temperature does not change, but the rate of heat dissipation is affected.
- Fuel of the proper grade for the lowest temperature.
- Heat to raise the engine block and component temperatures to at least –25°F (–32°C) for starting in lower temperatures.
- Electrical equipment capable of operating in the lowest expected temperature. All switches, connections, and batteries in the electrical system should be inspected and kept in good condition to prevent losses through poor contacts.

Arctic specifications refer to the design of material and specifications of components necessary for satisfactory engine operation in extremely low temperatures to –65°F (–54°C). Contact the nearest Freightliner dealer or Cummins engine dealer to obtain the special items required.

NOTICE

Antileak antifreezes are not recommended for use in Cummins engines. Although these antifreezes are chemically compatible with DCA water treatment, the antileak agents may clog the coolant filters.

IMPORTANT: Fuel heaters used on vehicles with Cummins CELECT Plus engine systems could cause high fuel temperatures that affect engine performance and operation of the electronic engine controls. If a fuel heater is used, make sure it has thermostatic controls. If the fuel heater has a timer, set the timer to activate only for a limited period of time before the engine starts. Make sure the fuel heater is used only for starting the engine.

For more information, see the Cummins engine operation manual supplied with the vehicle.

DDE S60

Preparations made in advance of winter and maintenance performed during the cold months will help to ensure efficient engine starting and operation.

- Engine oil thickens as it gets colder, slowing cranking speed. When cold, multi-grade oil offers less resistance to the cranking effort of the engine and permits sufficient rpm to be developed to start the engine. See "How to Select Lubricating Oil" in the Detroit Diesel *Engine Operator's Guide* for specific recommendations.
- When an engine equipped with a DDEC system is started at temperatures below 25°F (–4°C), the idle speed automatically increases to 900 rpm. The injection timing is also advanced to decrease white smoke. As the engine oil warms up, the idle speed gradually decreases. When the oil temperature reaches 122°F (50°C), both the idle speed and the injection timing return to normal.
- A winterfront may be used to improve cab heating while idling. At least 25% of the grille opening should should remain open in sectioned stripes that run perpendicular to the charge air cooler tube flow direction. This assures even cooling across each tube and reduces header-to-tube stress, and possible failure. Winterfronts should only be used when the ambient temperature remains below 10°F (–12°C).
- During cold weather, the batteries should be tested more frequently to ensure ample power for starting. All electrical connections should be tight and in good condition to prevent losses through loose or corroded connections.
- Ethylene glycol based antifreeze is recommended. An inhibitor system is included in this type of antifreeze, and the corrosion protection is sufficient as long as the recommended concentration range of 30 to 67 percent (antifreeze to water by volume) is employed.
- If the engine is to be operated in arctic temperatures, consult the nearest Freightliner dealer or an authorized Detroit Diesel engine dealer for information regarding availability of special cold-weather equipment.

Mercedes-Benz

IMPORTANT: At outside temperatures below –4°F (–20°C), a coolant preheater is recommended. For service products to use in cold weather, see the M-B Engine Operator's Manual supplied with the vehicle for details.

Periodically check the coolant mixing ratio (concentration of antifreeze in the coolant). Add more if necessary. The coolant mixing ratio should never rise above 60 percent antifreeze.

Use low-viscosity lubricating oils for adequate lubrication.

At temperatures below 32°F (0°C), do not use summer-grade (2-D) diesel fuel. To avoid fuel problems due to paraffin separation, use winter-grade (1-D or winterized 2-D) diesel fuel only.

⚠ WARNING

The addition of kerosene lowers the flash point of diesel fuel. To prevent fire and risk of injuries due to burning, do not smoke or use open flames around fuel mixed with kerosene. Comply with all appropriate safety regulations.

NOTE: Engine power may drop according to the proportion of kerosene. For this reason, never add more than 50 percent kerosene to the fuel.

High Altitude Operation

Engines lose horsepower when operated at high altitude because the air is too thin to burn as much fuel as at sea level. This loss is about three percent for each 1000 feet (300 m) altitude above sea level for a naturally aspirated engine. Most turbocharged engines are rated for higher altitudes than naturally aspirated engines.

An engine will have smoky exhaust at high altitudes unless a lower gear is used. The engine will not demand full fuel from the fuel system unless the engine is altitude-compensated by the use of a turbocharger. Shift gears as needed to avoid excessive exhaust smoke.

Engine Shutdown—CAT, Cummins, DDE S60, M-B

Caterpillar

NOTICE

Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of the engine components. Excessive temperatures in the turbocharger center-housing will cause oil coking problems. Follow the procedure outlined below to allow the engine to cool.

1. With the vehicle stopped, apply the parking brakes. Reduce the engine speed to low idle.
2. Place the transmission shift lever in neutral.

NOTE: If the engine has been operating at low loads, run it at low idle for 30 seconds before stopping. If the engine has been operating at highway speed or at high loads, run it at low idle for three minutes to reduce and stabilize internal engine temperatures before stopping.

3. Turn off the ignition switch and shut down the engine.
4. After engine shutdown, fill the fuel tank.
5. Check the crankcase oil level. Maintain the oil level between the add and full marks on the dipstick.
6. If equipped with an idle shutdown timer, it can be set to shut the engine down after a preset amount of time. Ninety seconds before the preset shutdown time, the CHECK ENGINE light will begin to flash at a rapid rate. If the clutch pedal or service brake indicate a position change during this final ninety seconds the idle shutdown timer will be disabled until reset.
7. If freezing temperatures are expected, allow the engine jacket water expansion tank to cool, then check the coolant for proper antifreeze protection. The cooling system must be protected against freezing to the lowest expected outside temperature. Add permanent-type antifreeze, if required.

8. Repair any leaks, perform minor adjustments, tighten loose bolts, etc. Observe the vehicle mileage or the service meter reading, if so equipped. Perform periodic maintenance as instructed in the Maintenance Interval Schedule in the Caterpillar *Operation and Maintenance Manual*.

Cummins

NOTICE

When safe to do, shut down the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine. Failure to do so could damage the engine.

1. With the vehicle stopped, apply the parking brakes, and place the transmission in neutral.

IMPORTANT: Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 100°F (56°C). The extreme heat may cause bearings to seize or oil seals to leak.

2. Idle the engine three to five minutes before shutting it down. This allows the lubricating oil and the water to carry heat away from the combustion chamber, bearings, shafts, etc. This is especially important with turbocharged engines.

NOTE: Do not idle the engine for excessively long periods. Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low the fuel may not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and may result in stuck valves.

3. If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil; therefore, all moving parts of the engine will suffer from poor lubrication.
4. Turn off the ignition switch and shut down the engine.

DDE S60

1. With the vehicle stopped, apply the parking brakes, and place the transmission in neutral.
2. Allow the engine to run at idle for four to five minutes. This allows the engine to cool and the turbocharger to slow down.

NOTICE

After high-speed operation, shutting down the engine without idling may cause damage to the turbocharger, as it will continue to turn without an oil supply to the bearings.

3. Turn off the ignition switch and shut down the engine.

Mercedes-Benz

If any of the following occur, shut down the engine immediately.

- The oil pressure swings back and forth or falls sharply.
- Engine power and rpm fall even though the throttle pedal remains steady.
- The exhaust pipe gives off heavy smoke.
- The coolant and/or oil temperature climb abnormally.
- Abnormal sounds suddenly occur in the engine or turbocharger.

1. With the vehicle stopped, apply the parking brakes and place the transmission in neutral.

NOTICE

Idle the engine one to two minutes before shutting it down, if this can be done without damage to the engine. After hard operation, shutting down the engine without idling may cause damage to the turbocharger.

2. Allow the engine to idle one to two minutes before shutting it down. This allows the lubricating oil and the coolant to carry heat away from the combustion chambers, bearings, shafts, and

seals. The extreme heat may cause bearings to seize or oil seals to leak.

IMPORTANT: Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 115°F (63°C).

NOTICE

Except in emergency, do not shut down the MBE4000 engine when the coolant temperature is above 194°F (90°C). To do so could damage the engine.

3. Turn off the ignition switch and shut down the engine.

Optional Engine Systems

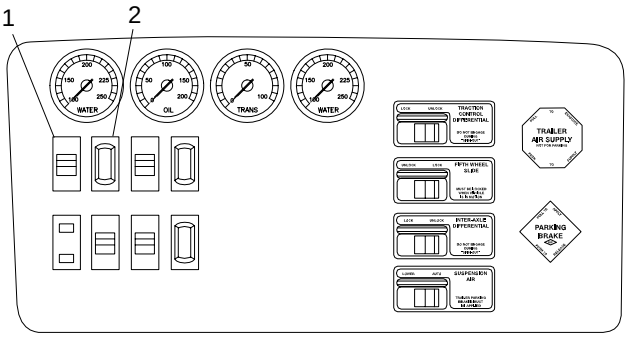
Cruise Control

IMPORTANT: On vehicles with Eaton VORAD Collision Warning System (CWS) with Smart-Cruise, read the operating instructions in *Collision Warning System* in **Chapter 2** before operating the cruise control.

The cruise control is activated by the SPD CNTL (on/off) and RSM/ACC–SET/CST switches on the dash (**Fig. 7.11**) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob (**Fig. 7.12**). The minimum speed at which cruise control can be used is 30 mph (48 km/h). The minimum and maximum speed cruise control set limits can be programmed, by authorized personnel, into the engine electronics.

WARNING

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, slippery, or roads with a loose driving surface. Failure to follow this precaution could cause a collision or loss of vehicle control, possibly resulting in personal injury or property damage.



1. RSM/ACC–SET/CST Switch
2. SPD CNTL (On/Off) Switch

Fig. 7.11, Cruise Control Switches, Dash-Mounted

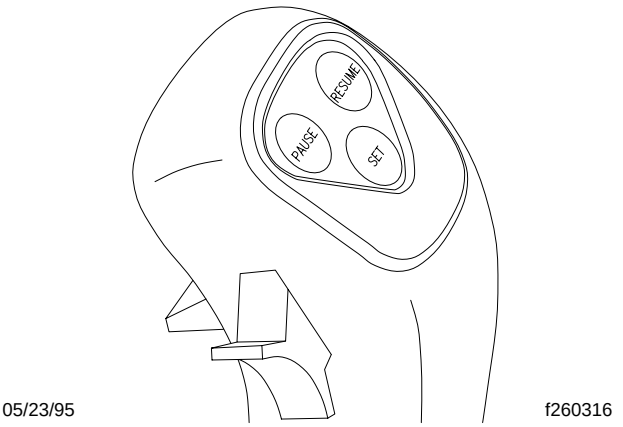


Fig. 7.12, Cruise Control, Transmission Shift Knob Buttons

NOTICE

Do not attempt to shift gears without using the clutch pedal when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

1. To cruise at a particular speed:
   - 1.1 Press the upper half of the SPD CNTL (on/off) rocker switch on the instrument control panel.
   - 1.2 Hold the throttle down until the speedometer reaches the desired speed.

1.3 Momentarily flip the RSM/ACC–SET/CST paddle switch on the instrument control panel down to SET/CST or push the SET button on the transmission shift knob.

2. To disengage the cruise control:

2.1 Depress the brake pedal or clutch pedal, *or*

2.2 Press the lower half of the SPD CNTL rocker switch on the instrument control panel or push the PAUSE button on the transmission shift knob.

3. To resume a preselected cruise speed:

3.1 If the SPD CNTL rocker switch on the instrument control panel is off, turn it on.

3.2 Momentarily flip the RSM/ACC–SET/CST paddle switch on the instrument control panel to RSM/ACC or push the RESUME button on the transmission shift knob. Cruise will return to the last speed selected.

NOTE: The resume vehicle speed memory is not maintained if the ignition is shut off.

4. To adjust cruise speed up or down, hold the paddle switch on the instrument control panel at RSM/ACC to accelerate or at SET/CST to decelerate until the desired speed is reached or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

Power Takeoff (PTO) Governor

The vehicle must be parked before engaging the PTO. The PTO mode is activated by the SPD CNTL and RSM/ACC–SET/CST switches on the dash (**Fig. 7.11**) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob (**Fig. 7.12**).

1. To engage the PTO:

1.1 Press the upper half of the SPD CNTL rocker switch on the instrument control panel.

1.2 Hold the throttle down until the tachometer reaches the desired engine speed.

1.3 Momentarily flip the paddle switch on the instrument control panel down to SET/CST or push the SET button on the transmission shift knob.

2. To disengage the PTO:

2.1 Depress the brake pedal or clutch pedal, *or*

2.2 Press the lower half of the SPD CNTL rocker switch on the instrument control panel or press the PAUSE button on the shift knob.

3. To resume a previously selected engine speed:

3.1 If the SPD CNTL switch on the instrument control panel is turned off, turn it on.

3.2 Momentarily flip the paddle switch on the instrument control panel up to RSM/ACC or press the RESUME button on the transmission shift knob.

4. To adjust engine speed up or down, hold the RSM/ACC–SET/CST paddle switch up to accelerate or down to decelerate until the desired speed is reached or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

NOTE: The resume engine speed memory is not maintained if the ignition is shut off.

Engine Braking Systems

The engine brake is enabled by an ON/OFF switch, with a separate intensity switch to select low, medium, or high braking power.

⚠ WARNING

To avoid injury from loss of vehicle control, do not activate the engine brake system under the following conditions:

- **on wet or slippery pavement**
- **when driving without a trailer (bobtailing) or pulling an empty trailer**
- **if the tractor drive wheels begin to lock, or there is fishtail motion after the engine brake is activated**

If the engine is equipped with both cruise control and an engine brake, the engine brake can operate automatically while in cruise control mode. If the cruise control/engine brake function is turned on, the engine brake will come on “low” when the set road speed increases a few miles-per-hour (kilometers-per-hour) above the cruise set speed. The maximum amount of braking (low, medium, high) is selected with the dash switches. When the vehicle returns to the set cruise speed, the engine brake will turn off.

The engine brake will only operate when the accelerator pedal is fully released. Disengaging the clutch will prevent the engine brake from operating.

Vehicles equipped with antilock braking systems (ABS) have the ability to turn the engine brake off if a wheel-slip condition is detected. The engine brake will automatically turn itself back on once the wheel slip is no longer detected. The system will deactivate the engine brake when the engine speed falls below 1000 rpm or when the vehicle slows down to a preset speed, depending on programming, to prevent stalling the engine.

For a specific explanation of the engine brake system for your vehicle, see the engine operation manual supplied with the engine.

Jacobs Engine Brake Operation

⚠ WARNING

Do not use the engine brake if road surfaces are slippery. Using the engine brake on wet, icy, or snow-covered roads could result in loss of vehicle control, possibly causing personal injury and property damage.

A Jacobs engine brake is a hydraulic-electric engine attachment that converts a diesel engine into an air compressor. This is done by changing engine exhaust valve operation. An engine brake is not a substitute for a service braking system, except in emergencies, because it does not provide the precise control available from the service brakes.

To engage the engine brake, the dash switch must be in the LO or HI position and both the clutch and throttle pedals must be fully released. To disengage the engine brake, depress the throttle or clutch pedal, or move the dash switch to OFF. Use the LO position when driving on flat, open stretches of road. If you need to use the service brakes to slow down, switch to a higher position until there is no need for the service brakes.

⚠ WARNING

The engine brake must be disengaged when shifting gears. The clutch must be used if the dash switch is in the LO or HI position. If the engine brake is engaged when the transmission is in neutral, the braking power of the engine brake can stall the engine, which could result in loss of vehicle control, possibly causing personal injury and property damage.

Since the engine brake is most effective at rated engine speed, gear selection is very important. Gearing down the vehicle within the limits of the rated engine speed makes the engine brake more effective. Recommended engine braking speed is above 1800 rpm and below the rated speed.

IMPORTANT: Maximum retarder performance is obtained when you use the lowest possible gear without exceeding the recommended engine braking speed.

"Control speed" is the speed at which the engine brake performs 100 percent of the required downhill braking, resulting in a constant speed of descent. The control speed varies, depending on vehicle weight and the downhill grade.

Below a set engine speed (set at the factory to 700 rpm), the engine control unit (ECU) will not engage the engine brake. The engine brake will not work below the set engine speed.

For faster descent, select a higher gear than that used for control speed. Service brakes must then be used intermittently to prevent engine overspeed and to maintain desired vehicle speed.

IMPORTANT: When descending a grade, remember that frequent use of service brakes causes them to become hot, which results in a reduction of their stopping ability. Grade descent speed should be such that the service brakes are used infrequently and that they remain cool, thus retaining their effectiveness.

A driver may descend slower than control speed by selecting a lower gear, one that will not overspeed the engine. The engine brake retarding force will

then be sufficient to cause vehicle deceleration. Occasional deactivation of the engine brake may be necessary to maintain the designated road speed under these conditions.

⚠ WARNING

Using the engine brake as a primary braking system when the service brakes are operable is dangerous. This can cause long, unpredictable stopping distances, possibly resulting in personal injury or property damage.

Whenever vehicle braking is required, the engine brake may be used with the service brakes. There is no time limit for operation of the engine brake.

1. After the engine is warmed up and the vehicle is in motion, move the paddle switch to the desired position, LO or HI. Depending on the engine model, LO will provide 1/3 or 1/2 of the full braking capacity of the engine. HI will provide maximum engine braking.
2. The engine brake activates when the dash switch is in LO or HI position and the driver's feet are removed from both the clutch and throttle pedals. If it fails to activate, take the vehicle to an authorized Freightliner dealer for service.
3. To obtain maximum retarding, maintain the top governed speed of the engine through appropriate selection of gears when the engine brake is in use.
4. When either the clutch or throttle pedal is depressed, the engine brake is deactivated.

NOTICE

If the engine brake fails to shut off when either the throttle or clutch pedal is depressed, place the dash switch in the OFF position and do not use the engine brake until the throttle or clutch switch system is repaired. If the engine brake fails to shut off when the dash switch is turned off, the engine should be shut down and the engine brake repaired before continuing operation. Failure to do so could result in damage to the engine.

Turbo Brake (MBE4000 only)

For high braking output, the Mercedes-Benz MBE4000 engine can be equipped with an optional turbo brake. The turbo brake redirects the exhaust gas flow through the turbocharger to provide 600 brake horsepower.

The turbo brake can be operated either manually or automatically, through the cruise control function.

Because the charge air pressure is maintained at a high level during braking, full throttle response is available immediately, if the operator desires it, without any turbo lag.

The turbo brake is maintenance-free, highly reliable, and adds virtually no weight to the engine.

Constant-Throttle Valves (MBE4000 only)

To increase braking performance, the Mercedes-Benz MBE4000 engine can be equipped with constant throttles in each combustion chamber. Small valves built into the cylinder head allow a small amount of compressed air to escape through the exhaust port during the combustion stroke. The constant-throttle valves are open during the entire time that the engine brake is activated. Although some braking ability is lost because the valves are constantly open, constant-throttle braking is quieter in operation than other types of engine brakes.

When both the exhaust brake and the constant throttles are installed, a three-position switch on the dash controls the engine braking system. Like the engine brake, the constant throttles are deactivated when the accelerator or clutch pedal is depressed. The ABS system, when active, also deactivates constant-throttle braking.

Exhaust Braking System—CAT, Cummins, DDE S60, M-B

An exhaust brake is an optional auxiliary braking system that assists but does not replace the service brake system. The exhaust brake can be used alone or together with the constant-throttle valves for steep or long grades. The exhaust brake switch located on the control panel, in combination with the accelerator and clutch pedals, allows the driver to make maximum use of the exhaust brake in off-highway and mountain driving as well as in traffic or high-speed highway driving.

When only the exhaust brake is installed, a two-position switch on the dash controls the engine braking system. The exhaust brake is only active when the engine speed is between 900 and 2700 rpm. Depressing the accelerator or clutch pedal deactivates the exhaust brake. The ABS system, when active, also deactivates the exhaust brake.

The exhaust brake is a butterfly valve mounted in the exhaust pipe. When the driver's foot is not on the accelerator pedal and the exhaust brake switch is in the on position, an air cylinder shuts the butterfly valve which restricts the flow of exhaust gases and retards the engine. This retarding action is carried through the engine and drivetrain, slowing the vehicle and reducing the need for frequent service brake applications.

Exhaust brakes are not intended for use as the primary braking system during vehicle operation.

Before starting the engine, make sure that the exhaust brake switch is in the off position. Do not turn the exhaust brake on until the engine has reached normal operating temperatures.

While approaching a steep grade, make sure that the exhaust brake switch is in the on position. The exhaust brake comes on as soon as you remove your foot from the accelerator pedal. While going down the grade, use a low enough gear to safely descend with a minimum application of the service brakes. As a general guideline, use the same gear as you would to ascend the hill.

NOTICE

Do not allow the engine to exceed its governed speed, or serious engine damage could result.

Apply the service brakes to reduce the engine rpm or make a slower descent by using a lower gear.

⚠ WARNING

Do not use the exhaust brake when driving on slippery or low-traction road surfaces. Failure to follow this precaution could result in a loss of vehicle control and possible personal injury or property damage.

Make sure the exhaust brake is turned off before shutting off the engine.

Exhaust Brake Operating Characteristics

When you remove your feet from both the accelerator and clutch pedals, and the exhaust brake switch is in the on position, the exhaust brake is applied. The following conditions should exist if the brake is operating properly.

- A slight change in the sound of the engine may be noticed when the exhaust brake is applied.
- Exhaust smoke should appear normal.
- Engine temperature should remain in the normal operating range.
- Road speed usually decreases when the exhaust brake is applied during a descent. When the vehicle is carrying a heavy load or the grade is extremely steep, you may need to apply the service brakes occasionally.
- Do not expect a retarding effect similar to sudden hard application of the service brakes. The exhaust brake retards the vehicle with a smooth braking effect.
- During a descent, the tachometer usually shows a drop in rpm depending on the grade and the vehicle load.
- Depending on the grade and vehicle load, you may or may not feel the retarding force acting against your body when the brake is applied. The retarding force of the brake may not always be noticed, but it is actually preventing the vehicle from going much faster.

Optimized Idle®

The Optimized Idle option on Detroit Diesel vehicles is a system that automatically stops and restarts the engine to accomplish the following:

- keep the engine oil temperature between 60 to 104°F (16 to 40°C)
- keep the battery charged
- keep the cab or sleeper at a constant, desired temperature (if equipped with a thermostat)

The benefits of the system include reduced engine idle time, fuel savings, reduction of exhaust emissions and noise, increased starter and engine life, and less chance of dead batteries due to electrical loads.

Optimized Idle operates in two modes, the engine mode or the thermostat mode. The engine mode keeps the battery charged and the engine oil temperature within factory set limits. The thermostat mode is the same as the engine mode, but also keeps the cab and sleeper at a constant preset temperature.

The engine mode is always activated when the system is operated. The thermostat mode is activated when the thermostat is turned on.

The thermostat mode controls the set point, which is the desired temperature of the cab and sleeper, and the comfort zone, which is the number of degrees from the set point before the engine needs to heat or cool the cab. There are three comfort zones: 4°F (2°C), 7°F (4°C), or 10°F (6°C).

Vehicles equipped with Optimized Idle have a label and a dash light. The dash light is on the dash message center or the Driver Message Center, on the A panel. See **Fig. 7.13**. See **Fig. 7.14** for the dash label detail. If equipped with the thermostat mode, a thermostat is located in the sleeper, above the bunk. See **Fig. 7.15**.

1. Optimized Idle Light

Fig. 7.13, Optimized Idle Light

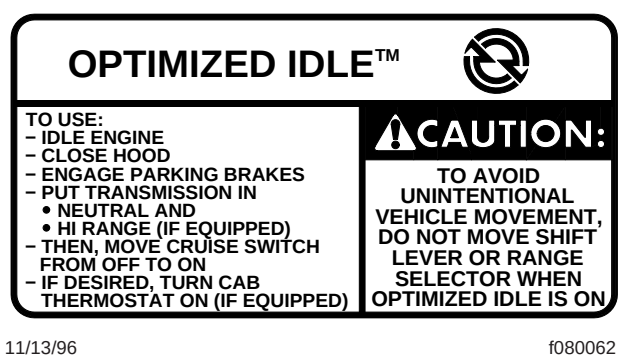

OPTIMIZED IDLE™
TO USE:
– IDLE ENGINE
– CLOSE HOOD
– ENGAGE PARKING BRAKES
– PUT TRANSMISSION IN
• NEUTRAL AND
• HI RANGE (IF EQUIPPED)
– THEN, MOVE CRUISE SWITCH FROM OFF TO ON
– IF DESIRED, TURN CAB THERMOSTAT ON (IF EQUIPPED)
CAUTION:
TO AVOID UNINTENTIONAL VEHICLE MOVEMENT, DO NOT MOVE SHIFT LEVER OR RANGE SELECTOR WHEN OPTIMIZED IDLE IS ON
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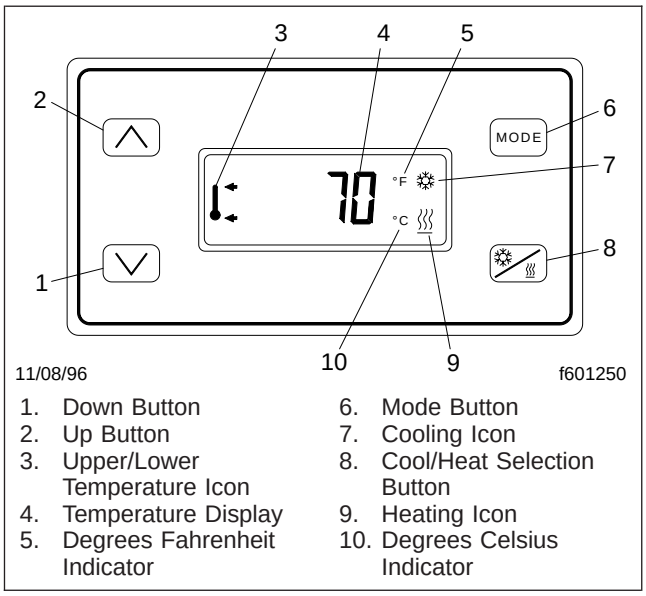
Fig. 7.14, Optimized Idle Dash Label



1. Down Button
2. Up Button
3. Upper/Lower Temperature Icon
4. Temperature Display
5. Degrees Fahrenheit Indicator
6. Mode Button
7. Cooling Icon
8. Cool/Heat Selection Button
9. Heating Icon
10. Degrees Celsius Indicator

Fig. 7.15, Optimized Idle Thermostat

The thermostat consists of an LCD readout and four buttons.

The display normally shows the temperature of the sleeper, but changes accordingly as the buttons are pressed.

- Up—increases the set point and comfort zone.
- Down—decreases the set point and comfort zone.
- Cool/heat—detects either cooling or heating operation.
- Mode—scrolls through the various functions. It can also be used to set desired temperature values.

1. Activate Optimized Idle (engine mode) as follows:

   1.1 Set the parking brake.

   1.2 If it is tilted, close and secure the hood.

   1.3 Start the engine and let it idle.

   1.4 Put the transmission in neutral.

   1.5 Turn on the cruise control.

   IMPORTANT: The cruise control must be turned on *after* the engine is idling. If it was

previously turned on, turn off the cruise control, then turn it on again.

1.6 The dash light will begin blinking, indicating that Optimized Idle is active. The system is now in the engine mode and after an initial phase, in which the idle speeds up to 1000 or 1500 rpm (depending on the outside temperature), the engine will stop and start automatically to keep the battery charged and the engine oil warm. The dash light stays on and shines steadily at this point.

2. Activate the thermostat mode (if so equipped) as follows:

NOTE: When the system is in the thermostat mode, it is also in the engine mode. It will continue to operate in the engine mode even if the thermostat mode is turned off.

2.1 With the system in the engine mode, set the cab and sleeper heater or air conditioner controls to the highest setting.

2.2 Turn on the thermostat by touching any of the four buttons. See **Fig. 7.15**.

The display will flash the current sleeper temperature and the previous mode (cooling or heating) selected. If the cab needs to be cooled or heated, the cool/heat icon will flash.

2.3 Choose either cool or heat by pressing the Cool/Heat button. Make sure the selection matches that of the cab controls.

IMPORTANT: If the heat or cool selection of the thermostat does not match that of the cab, the system will idle and cycle excessively.

2.4 Select Fahrenheit or Celsius by pressing and holding the Mode button until either the °F or °C is displayed.

2.5 Select the temperature set point by pressing either the UP button or the DOWN button, as applicable. Holding the button will cause the display to count up or down rapidly. When the desired set point is displayed, release the button. The set point is stored in memory.

2.6 Select the temperature comfort zone by pressing the MODE button until the upper and lower temperature limit icon is displayed. Then use the UP or DOWN button to select one of the three comfort zones of 4°F (2°C), 7°F (4°C), or 10°F (6°C).

3. To change the display to either Fahrenheit or Celsius, press the MODE button until only the °F or °C icon is flashing. Press the UP or DOWN button to change to the desired value. The main display will appear five seconds after the button is released.

4. To deactivate the thermostat mode and return to just the engine mode, press the MODE button and hold it for three seconds.

5. To shut down Optimized Idle completely, either turn off the ignition or use the drive away feature.

The drive away feature allows the use of all the DDEC features. Use the drive away feature as follows.

5.1 If the engine is running, release the parking brakes or put the transmission in gear.

If the engine is not running, start the engine, then release the parking brakes or put the transmission into gear.

5.2 Let the engine return to base idle. The active light will turn off. Optimized Idle is now disabled and all the DDEC features are available.

Clutches

General Information

The major reason clutches wear out too soon is excessive heat. Clutches are designed to absorb and dissipate more heat than encountered in typical operation. The heat generated in typical operation will not break down the clutch friction surfaces. However, if a clutch is slipped excessively or asked to do the job of a fluid coupling, high temperatures develop quickly and destroy the clutch. Temperatures generated between the flywheel, driven discs, and pressure plates can be high enough to cause the metal to flow and the friction facing material to char and burn.

Heat and wear are practically nonexistent when a clutch is fully engaged. But during the moment of

engagement when the clutch is picking up the load, it generates considerable heat. An improperly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

The most important items that a driver should be aware of to ensure long service life of the clutch include: starting in the right gear, clutch malfunctions, and when to adjust a clutch.

Clutch Operation

Valeo Clutch Break-In

With a new or newly-installed Valeo clutch, the clutch may slip for a short time while the friction surfaces break in. However, allowing the clutch to slip for more than two seconds can severely damage the clutch disc, pressure plate, and the flywheel.

During initial operation of a new vehicle or a vehicle with a new clutch, check for clutch slippage during acceleration. If the clutch slips, decelerate until the clutch does not slip. Allow the clutch to cool 15 to 30 seconds, and then gradually accelerate again. If the clutch continues to slip, repeat the procedure. If necessary, repeat the procedure up to five times. If the clutch slips after five attempts, stop the vehicle. Allow the clutch to cool for at least one hour. Notify your Freightliner dealer of the problem.

NOTICE

Do not allow sustained slippage of the clutch; this could severely damage the clutch disc, pressure plate, or flywheel. Damage caused by clutch slippage due to improper break-in is not warrantable.

Starting the Vehicle in the Proper Gear

An empty truck can be started in a higher transmission gear than a partially or fully loaded truck. A good rule of thumb for the driver to follow is: select the gear combination that allows you to start moving with an idling engine, or if necessary, just enough throttle to prevent stalling the engine. After the clutch is fully engaged, the engine should be accelerated to the correct rpm for the upshift into the next higher gear.

Gear Shifting Techniques

Many drivers upshift into the next gear, or even skip-shift into a higher gear, before the vehicle has reached the proper speed. This type of shifting is almost as bad as starting off in a gear that is too high, since the engine rpm and vehicle speeds are too far apart, requiring the clutch to absorb the speed difference with friction, creating heat. For transmission operating instructions, refer to **Chapter 8** in this manual.

The clutch brake is applied by fully depressing the clutch pedal. Its purpose is to stop the transmission gears from rotating in order to engage the transmission gears quickly in making an initial start.

NOTICE

Never apply the clutch brake when making downshifts or upshifts. The clutch pedal should never be fully depressed before the transmission is put in neutral. If the clutch brake is applied with the transmission still in gear, a reverse load will be put on the gear. At the same time, it will have the effect of trying to stop or decelerate the vehicle with the clutch brake. Rapid wear of the friction discs will take place necessitating frequent replacement. Considerable heat will be generated, which will be detrimental to the release bearings and transmission front bearings.

Proper Clutch Usage

NOTICE

Overloading will result in damage to the clutch, and possibly to the entire powertrain.

Clutches are designed for specific vehicle applications and loads. These limitations should not be exceeded.

Riding the clutch pedal is very destructive to the clutch, since partial clutch engagement permits slippage, generating excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing, which can thin out the lubricant. Release bearing failures can be attributed to this type of misuse.

A slipping clutch accumulates heat faster than it can be dissipated, resulting in early clutch failures. Never use the clutch as a hill holder.

⚠ WARNING

Do not coast with the clutch released (pedal depressed) and the transmission in gear. High driven-disc rpm could cause the clutch facing to be thrown off the disc. Flying debris could cause injury to persons in the cab.

Engaging the clutch while coasting can result in tremendous shock loads and possible damage to the clutch, as well as to the entire drivetrain.

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect and lubricate the clutch components, make necessary internal clutch and linkage adjustments, etc.

Free pedal should be included and commented on daily in the driver's report, since clutch free pedal is the maintenance department's guide to the condition of the clutch and the release mechanism.

Clutch free pedal is a decreased resistance felt at the top of the clutch pedal stroke. See **Fig. 7.16**. With the clutch pedal in this range, the clutch is fully engaged, and the only resistance to clutch pedal movement is the force of the return spring. If clutch free pedal is 3/4 inch (20 mm) or less, measured at the pedal, have the clutch adjusted.

Operating the vehicle with incorrect free pedal could result in clutch damage.

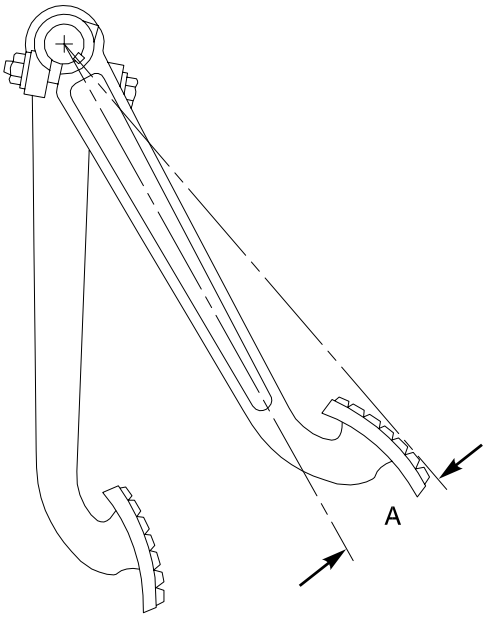
Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring) felt as the clutch pedal approaches the end of its stroke. If the gears grind when shifting into first or reverse gear with the clutch pedal fully depressed, the clutch is out of adjustment, or the clutch brake is worn and needs to be replaced.

Clutch Adjustments

Clutches have an internal adjustment, and external linkage adjustment. Refer to **Group 25** in the *Century Class Trucks Workshop Manual* for clutch adjustment procedures and specifications.

NOTICE

Operating the vehicle with the clutch improperly adjusted could result in clutch or clutch brake failure.



A. Free Pedal

Fig. 7.16, Clutch Free Pedal

Lubrication

On vehicles equipped with a greaseable release bearing, the release bearing and linkage should be lubricated at frequent intervals. Refer to **Group 25** in the *Century Class Trucks Maintenance Manual* for intervals and procedures.

NOTICE

Failure to lubricate the release bearing and linkage as recommended could result in release bearing and clutch damage.

8

Transmissions

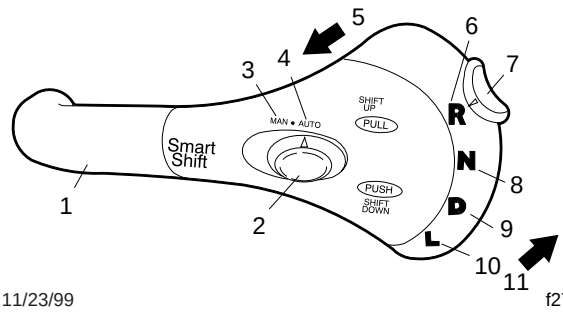
Freightliner SmartShift™ Transmission Shift Control 8.1
Fuller Straight-Shift Models 8.5
Fuller Range-Shift Models 8.6
Fuller Splitter and Range-Shift Models 8.8
Fuller Deep-Reduction and Range-Shift Models 8.11
Meritor Range-Shift Models 8.14
Meritor Splitter and Range-Shift Models 8.16
Allison Automatic Models 8.17
Meritor Engine Synchro Shift™ (ESS) Automated Models 8.19

Freightliner SmartShift™ Transmission Shift Control

General Information

The SmartShift transmission shift control is an electronic transmission control device. It is applicable to both automated mechanical and automatic transmissions but must be mated to an Eaton AutoShift or Meritor SureShift transmission. It replaces either the typical floor-mounted shift lever or dash-mounted push button control. The SmartShift control mounts to the right-hand side of the steering column and is operated by the driver's right hand. See **Fig. 8.1** and **Fig. 8.2**. SmartShift accepts driver requests for transmission functions and transmits them through hard wiring to the transmission control unit (TCU).

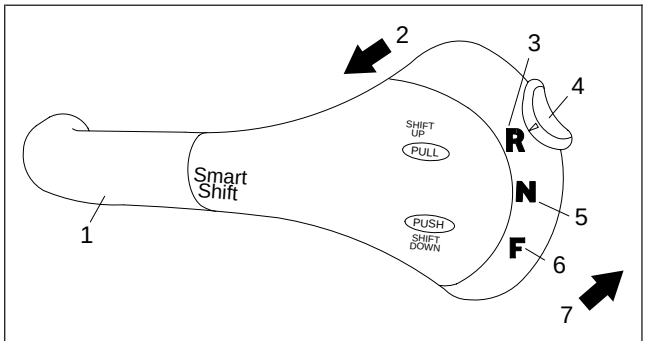
Refer to the Eaton website for additional information, **www.roadranger.com**.



1. SmartShift Control
2. Forward Driving Mode Switch (slide switch)
3. MAN Switch Position
4. AUTO Switch Position
5. Upshift Direction (in manual mode, pull upward)
6. Reverse Selector Position
7. Mode Selector Switch
8. Neutral Selector Position
9. Drive Selector Position
10. Low Selector Position
11. Downshift Direction (in manual mode, push downward)

Fig. 8.1, SmartShift Control (with Eaton AutoShift transmission)

SmartShift offers two main advantages over conventional transmission control devices; usable cab space is increased and access to the sleeper is improved by removing the shift lever from the floor. Because of the steering column mounting, the transmission control is within fingertip reach of the steering wheel, which enhances safety.



1. SmartShift Control
2. Upshift Direction (pull upward)
3. Reverse (R) Selector Position
4. Mode Selector Switch
5. Neutral (N) Selector Position
6. Forward (F) Selector Position
7. Downshift Direction (push downward)

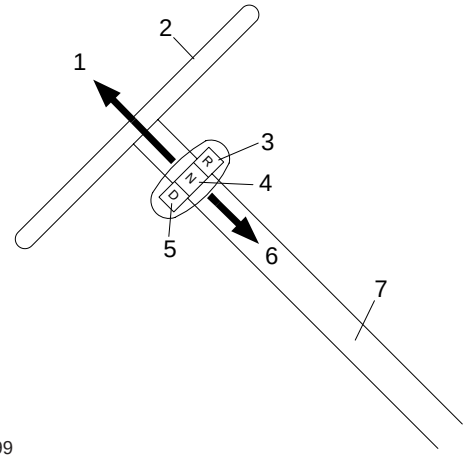
Fig. 8.2, SmartShift Control (with Meritor SureShift transmission)

SmartShift is a true shift-by-wire system. Manual gearshifts (all SureShift shifts and AutoShift when in manual mode) are accomplished by a momentary pull or push on the control in the plane perpendicular to the steering wheel. See **Fig. 8.3**. Pull upward (toward you) on the control to upshift and push downward (away from you) to downshift. For the Eaton AutoShift transmission, a four-position (R, N, D, L) linear mode selector switch (**Fig. 8.1**) is located at the end of the control. For the Meritor SureShift transmission, a three-position (R, N, F) linear mode selector switch (**Fig. 8.2**) is located at the end of the control. The control is spring-loaded and returns to mid-position when released after an upshift or downshift.

Operation: Eaton AutoShift Transmission

Automatic and Manual Modes

A two-position forward driving mode switch (slide switch) is located near the end of the control (**Fig. 8.4**). The switch positions are labelled MAN (manual shift mode) and AUTO (automatic drive mode).



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1. Upshift (in manual mode, pull upward)
2. Steering Wheel
3. Reverse Position
4. Neutral Position
5. Drive Position
6. Downshift (in manual mode, push downward)
7. Steering Column

Fig. 8.3, SmartShift Control Operation (Eaton AutoShift control, showing only R, N, D positions)

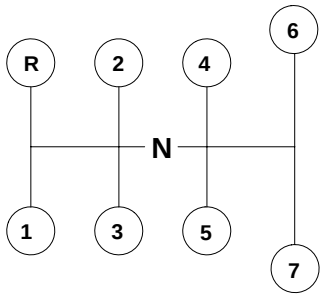

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Fig. 8.4, Fuller Straight-Shift Model Transmissions Shift Pattern

NOTE: In automatic drive mode, upshifts and downshifts require no driver interaction. Move the selector switch to the drive (D) position, disengage the clutch to engage the gear selected, engage the clutch and drive the vehicle. In manual shift mode, upshifts and downshifts require either a pull upward or push downward on the control.

Driver Message Center

Gear information is presented to the driver via the level III ICU Driver Message Center. In automatic drive mode, the number of the forward gear currently engaged appears continually on the message display screen when in drive (D). In manual shift mode, the current gear is displayed until a new gear is requested. When neutral (N) is engaged, "N" will appear on the message display screen. When reverse (R) is engaged on 10- or 18-speed AutoShift transmissions, either "RL" or "RH" will appear on the message display screen. AutoShift transmissions with fewer speeds do not have a dual range reverse gear and "R" will appear when reverse is engaged.

IMPORTANT: The information shown on the message display screen indicates the state of the transmission only, not the state of the SmartShift control.

Neutral Position

Select neutral (N) by sliding the selector switch to the "N" position.

NOTE: Neutral is always available during operation. When in neutral, upshift and downshift requests are ignored. If the mode selector switch is moved from neutral to drive (D) while the vehicle is moving, the transmission will shift into a gear causing the engine to go to a high torque level, under the engine's rated torque.

Selecting a Starting Gear

1. In automatic mode, select drive (D) by sliding the selector switch downward to the next position below the neutral position.
2. Disengage the clutch to engage the gear selected. Engage the clutch and drive the vehicle.

NOTE: In either the automatic or manual mode, a starting gear, other than the default starting gear, may be selected by either pulling upward or pushing downward on the control while the vehicle is stopped and in drive. Each pull upward on the control increases the starting gear by one gear, but no higher than fourth gear. The number of the gear selected will flash on the message display screen until the driver engages the clutch. This gear will be stored in memory

as the default starting gear until either a different starting gear is selected by the driver or the engine is shut down. The transmission may also be programmed so that it is not possible to select a starting gear other than the preprogrammed default starting gear.

Upshifting

NOTE: With the transmission in drive (D) in the automatic mode, upshifts require no driver interaction.

1. With the transmission in drive in the manual mode, request an upshift by pulling upward on the control. If the requested gear is available, the transmission will upshift.

NOTE: A single, momentary pull upward on the control selects the next higher gear when it is available. Two consecutive, momentary upward pulls will cause a skip shift when the next two higher gears are available and conditions are right.

2. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

NOTE: The Eaton AutoShift 18-speed transmission is able to perform triple upshifts when the next three higher gears are available and conditions are right. To triple shift this transmission, move the control three times in less than 1/2 second.

If a requested gear is not available, an audible warning will sound and the message display screen will indicate that the gear is not available. An unavailable requested upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: With the transmission in drive (D) in the automatic mode, downshifts require no driver interaction.

1. With the transmission in drive in the manual mode, request a downshift by pushing downward on the control. If the requested gear is available, the transmission will downshift.

NOTE: A single, momentary push downward on the control selects the next lower gear when it is available. Two consecutive, momentary downward pushes will cause a skip shift, when the next two lower gears are available and conditions are right.

2. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

NOTE: The Eaton AutoShift 18-speed transmission is able to perform triple downshifts when the next three lower gears are available and conditions are right. To triple shift this transmission, move the control three times in less than 1/2 second.

If a requested gear is not available, an audible warning will sound and the message display screen will indicate that the requested gear is not available. Unlike upshifting, an unavailable requested downshift is stored in memory and the shift will be made when the gear is available. The time limit for this memory is a programmable parameter.

Reverse

1. To engage reverse (R), slide the selector switch upward to the next position above the neutral position and disengage the clutch.

NOTE: AutoShift 10- and 18-speeds transmissions have a dual range reverse. Reverse low (RL) is the default reverse gear.

2. On AutoShift 10- and 18-speed transmissions, select reverse high (RH) by pulling upward on the control.

NOTE: Reverse may be engaged below a programmable forward speed in order to rock the vehicle. If reverse is selected above the programmed forward speed, an audible warning will sound and a message indicating that the gear is not available will appear on the message display screen.

Low Gear Operation

Use low (L) when descending steep hills and using compression braking. Engine speed will be increased by 200 rpms and shift points will be offset by 200 rpms. The efficiency of the exhaust brake will be maximized.

Using the Clutch

Use the clutch to start and stop the vehicle.

Operation: Meritor SureShift Transmission

Manual Mode

There is no slide switch on the Meritor control as only the manual mode is available.

Driver Message Center

Gear information is presented to the driver via the level III ICU Driver Message Center. The current forward numerical gear is displayed until a new gear is requested. During the shifting process, the letters "SH" appear until the shift is completed. Then, the newly engaged numerical gear is displayed. When neutral (N) is engaged, "N" will appear on the message display screen. When reverse (R) is engaged, "RL" will appear on the message display screen.

IMPORTANT: The information shown on the message display screen indicates the state of the transmission only, not the state of the SmartShift control.

Neutral Position

Neutral (N) is in the center of the three positions of the selector switch at the end of the control. Select neutral by sliding the mode selector switch to the center position.

NOTE: Neutral is always available during operation. When in neutral, upshift and downshift requests are ignored. If the mode selector switch is moved from neutral to forward (F) while the vehicle is moving, the transmission will shift into a gear causing the engine to go to a high torque level, under the engine's rated torque.

Selecting a Starting Gear

1. Select forward (F) by sliding the selector switch downward to the next position below the neutral position.

NOTE: When forward is selected, the transmission controller is signaled to engage the default starting gear.

2. Select a different starting gear by pulling upward on the control while the vehicle is stopped and in forward, before disengaging the clutch to engage the selected gear.

NOTE: Each pull upward on the control increases the starting gear by one gear, but no higher than fourth gear. The number of the selected starting gear is displayed for one second and then the signal to disengage the clutch "CL" is displayed. Disengaging the clutch will engage the selected starting gear, which will now be stored in memory as the default starting gear. However, when the transmission controller is reinitialized at the beginning of another power cycle, the starting gear will default to the originally preprogrammed starting gear. The transmission may also be programmed so that it is not possible to select a starting gear other than the preprogrammed default starting gear.

Upshifting

With the transmission in forward (F), request an upshift by pulling upward on the control. If the requested gear is available, the transmission will upshift.

NOTE: If a requested gear is not available, an audible warning will sound and a message will appear on the message display screen advising that the gear is not available. An unavailable requested upshift is not stored in memory. The upshift must be requested again. All shift requests with the clutch disengaged, while the vehicle is in motion, will be ignored. Skip shifting is not available with the Meritor version of SmartShift.

Downshifting

With the transmission in forward (F), request a downshift by pushing downward on the control. If the requested gear is available, the transmission will downshift.

NOTE: If a requested gear is not available, an audible warning will sound and a message will appear on the message display screen advising that the gear is not available. An unavailable requested downshift is not stored in memory. The downshift must be requested again. All shift requests with the clutch disengaged, while the vehicle is in motion, will be ignored. Skip shifting is not available with the Meritor version of SmartShift. While in the forward position in the lowest available gear, a downshift request will not cause a shift into neutral.

Reverse

1. To select reverse (R), slide the mode selector switch upward to the next position above the Neutral position.

NOTE: Reverse low (RL) is the default reverse gear.

2. Select reverse high (RH) by pulling upward on the control before disengaging the clutch.

NOTE: It is not possible to shift between low range reverse and high range reverse with the vehicle in motion. If reverse is selected above the minimum detectable speed in forward, an audible warning will sound and a warning message will appear on the message display screen.

Using the Clutch

Use the clutch to start and stop the vehicle.

Fuller Straight-Shift Models

General Information

Fuller T–14607A/B and TX–14607B transmissions have seven forward speeds and one reverse speed. They are designed for use with on-highway, fuel economy engines, where a minimum of shifting is desired and less gear reduction is acceptable. See **Fig. 8.4** for the shift pattern.

Operation

1. Always use 1st gear when starting to move the vehicle forward.
2. Use the clutch brake to stop gear rotation when shifting into 1st or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

   For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Use double-clutching between all upshifts and downshifts.
4. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

   Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Upshifting

1. Position the gear shift lever in neutral, then start the engine. Bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Depress the clutch pedal to the floor; shift into 1st gear, then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to engine governed speed.
3. Once governed speed has been reached, disengage the clutch, and shift the lever to neutral. Engage the clutch; allow the engine speed to drop about 800 rpm (the rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 2nd gear, then engage the clutch, and accelerate to engine governed speed.

   Continue shifting upward, from 2nd to 3rd gear, 3rd to 4th gear, and 4th to 5th gear, using the same sequence. See **Fig. 8.4** for the shift pattern.
4. Again, at governed speed, disengage the clutch, and shift into neutral. Engage the clutch; allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 6th gear, then engage the clutch, and accelerate to engine governed speed.

Shift into 7th gear, using the same sequence.

Downshifting

When downshifting, shift down from 7th gear through each lower gear, as follows:

1. Allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. While holding full throttle, disengage the clutch; shift into gear; engage the clutch smoothly.

   Follow the same sequence to downshift from 6th into 5th gear.

2. When in 5th gear, and ready for the next downshift, allow the engine speed to drop about 800 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. While holding full throttle, disengage the clutch; shift into 4th gear; engage the clutch smoothly.

   Follow the same sequence to downshift from 4th into 3rd, 3rd into 2nd, and from 2nd into 1st gear.

   Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Fuller Range-Shift Models

General Information

9-Speed RT, RTO, and RTX Models

Fuller RT–8608L, RT–8609, RT–11609A, RT–11709H, RT–12609A, RT–12709H, RT–13609A, RT–13709H, RT–14609A, RT–14709H, RTO–11909MLL, RTO–14909MLL, RTX–11609B/R, RTX–11709H, RTX–12609B/R, RTX–12709H, RTX–13609B/R, RTX–13709H, RTX–14609B/R, RTX–14709H, and RTX–16709B/H transmissions have a 5-speed front section, and a 2-speed rear range section. The low gear in the front sections of the RT-8609 and A and B ratio transmissions is used only as a starting ratio. The high gear in the front section of the "R" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range.

See **Fig. 8.5** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RT (direct ratio) and RTX-B (overdrive ratio) transmissions are opposite of the RTO (overdrive ratio) transmissions. The RTX-R ratio transmissions have the 1st/5th shift positions where LO is in the A and B ratio transmissions. The top gear in the RTX-R ratio transmissions is called 9th gear.

10-Speed RT, RTO and RTX Models

Fuller RT–11710B, RT–12710B, RT–13710B, RT–14710B, RTO–15210C, RTO–16210C, RTLO–12610B, RTLO–13610B, RTLO–14610B, RTLO–15710B/C, RTLO–16610B, RTX–11710B/C, RTX–12710B/C, RTX–13710B/C, RTX–14710B/C, RTX–15710B/C and RTX–16710B transmissions have ten selective, evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed rear range section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range; the second time in high range. See **Fig. 8.6** for the shift patterns, noting that the 4th/9th and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation

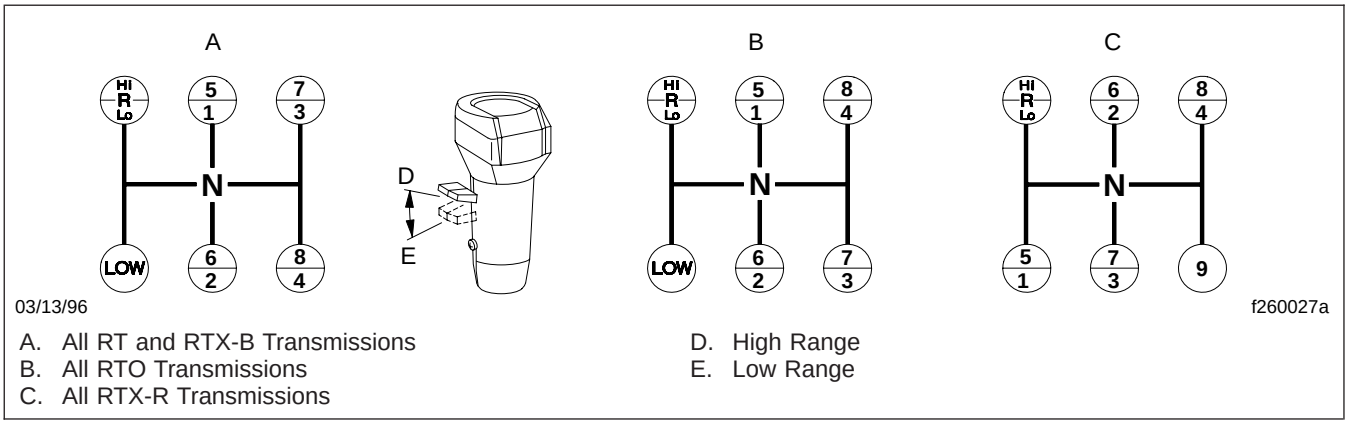
1. When operating off-highway, or under adverse conditions, always use low gear (if so equipped) when starting to move the vehicle.

   When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle (except when equipped with a 9-speed RTO transmission, then always start in low gear).

   For all conditions, use the highest gear that is still low enough to start the vehicle moving with engine idling, and without slipping the clutch excessively.

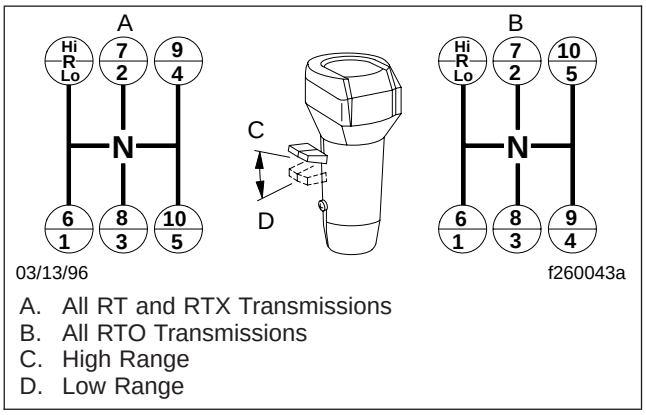
2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

   For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.



A. All RT and RTX-B Transmissions
B. All RTO Transmissions
C. All RTX-R Transmissions
D. High Range
E. Low Range

Fig. 8.5, Fuller 9-Speed RT, RTO, and RTX Model Transmissions Shift Patterns



A. All RT and RTX Transmissions
B. All RTO Transmissions
C. High Range
D. Low Range

Fig. 8.6, Fuller 10-Speed RT, RTO and RTX Model Transmissions Shift Patterns

3. Do not make range shifts with the vehicle moving in reverse gear.
4. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
5. Do not shift from high range to low range at high vehicle speeds.
6. Use double-clutching between all upshifts and downshifts.
7. After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

1. Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range.
3. Depress the clutch pedal to the floor; shift into low or 1st gear (**Table 8.1**), then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
4. Shift progressively upward from low or 1st gear, to the top gear in low range (**Table 8.1**), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
5. While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral, and shift into the bottom gear in high range (**Table 8.1**). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
6. With the transmission in high range, shift progressively upward through each of the high range gears (**Table 8.1**), double-clutching between shifts.

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.

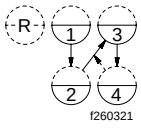
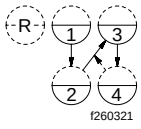
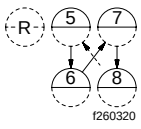
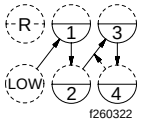
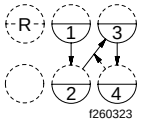
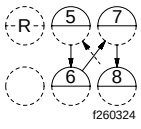
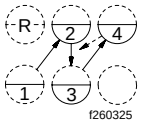
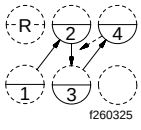
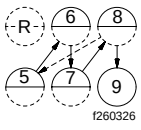
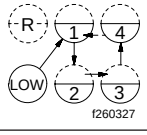
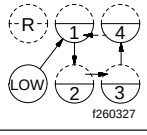
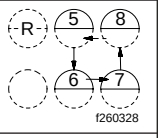
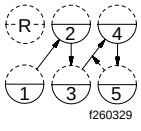
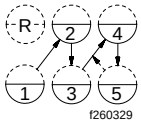
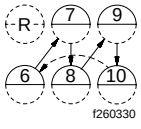
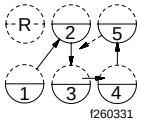
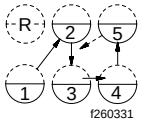
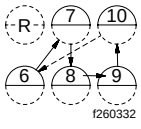
Fuller Shift Progressions			
TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
8-Speed Direct (RT)	 f260321	 f260321	 f260320
9-Speed Direct or Overdrive (RT or RTX)	 f260322	 f260323	 f260324
9-Speed Direct (RTX-P)	 f260325	 f260325	 f260326
9-Speed Overdrive (RTO)	 f260327	 f260327	 f260328
10-Speed Direct or Overdrive (RT or RTX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RTO)	 f260331	 f260331	 f260332

Table 8.1, Fuller Shift Progressions

2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

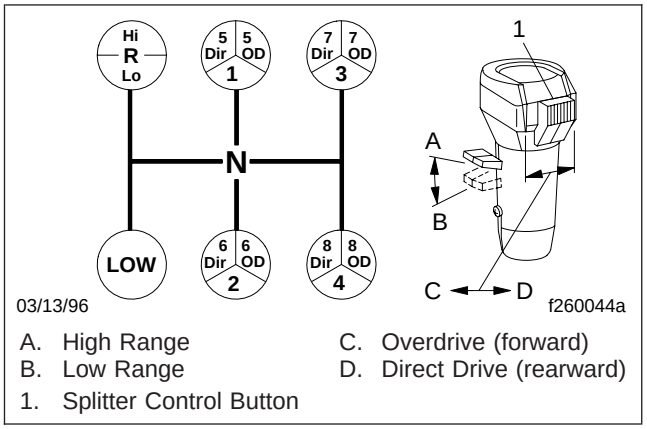
   Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Fuller Splitter and Range-Shift Models

General Information

13-Speed RTO Models

Fuller RTLO–12713A, RTLO–14713A, and RTLO–16713A transmissions have thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See **Fig. 8.7** for the shift pattern.



A. High Range
B. Low Range
C. Overdrive (forward)
D. Direct Drive (rearward)
1. Splitter Control Button

Fig. 8.7, Fuller 13-Speed RTO Transmissions Shift Pattern

All of the thirteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range preselection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high range gear positions can be split with the underdrive ratio (RT models), or overdrive ratio (RTO models) of the splitter gear. Ratios cannot be split while the transmission is in low range.

18-Speed RTO Models

Fuller RTLO–14718B, RTLO–16718B and RTLO–18718B transmissions have eighteen forward speeds and four reverse, consisting of a 5-speed front section and a 3-speed auxiliary section. The auxiliary

section contains low and high range ratios, plus an overdrive splitter gear.

One ratio in the front section (low) is used as a starting ratio; it is never used when the transmission is in high range.

The other four ratios in the front section are used once in low range and once again in high range; however, each of the five ratios (low–1–2-–3–4) in low range and each of the four ratios (5–6–7–8) in high range can be split with the overdrive splitter gear.

All of the eighteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range preselection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Operation

IMPORTANT: On 13-speed transmissions, the shifter knob has an interlock feature that prevents the splitter control button from being moved forward when the range preselection lever is down (in low range); when in high range and the splitter control button is in the forward position, the range preselection lever cannot be moved down.

1. When operating off-road, or under adverse conditions, always use low gear when starting to move the vehicle forward.

   When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle forward.

   For all conditions, use the highest gear that is still low enough to start the vehicle moving with the engine at or near idle speed, and without slipping the clutch excessively.

2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

   For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Use double-clutching between all upshifts and downshifts that require movement of the shift lever. Splitting of the high range gears does not require movement of the shift lever.

4. Never move the shift lever into low gear while in high range.

5. Never move the splitter control button while in neutral.

6. Do not preselect with the splitter control button; after moving the control button, complete the shift immediately.

7. Except when downshifting from 5th direct to 4th gear, never push the range preselection lever down into low range while operating in high range–the splitter will become inoperative.

8. Do not shift from high range to low range at high vehicle speeds.

9. Do not make range shifts with the vehicle moving in reverse gear.

10. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.

11. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

1. Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).

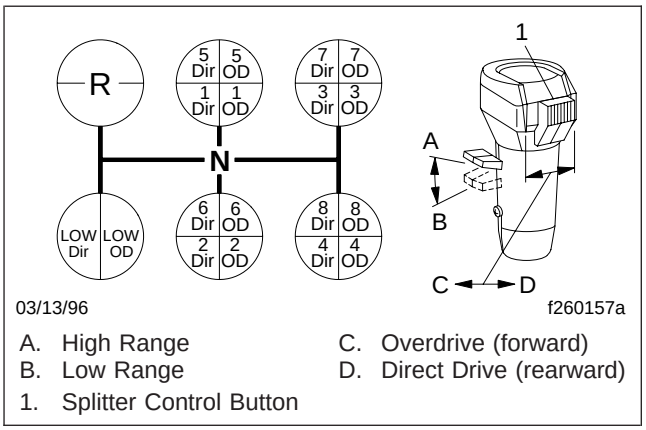
2. Position the range preselection lever down, into low range. See **Fig. 8.7** or **Fig. 8.8**.

3. Make sure the splitter control button is in the direct (rearward) position. See **Fig. 8.7** or **Fig. 8.8**.

4. For 13-speed transmissions:

   Depress the clutch to the floor, shift into low or 1st gear; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.

   For 18-speed transmissions:



A. High Range
B. Low Range
C. Overdrive (forward)
D. Direct Drive (rearward)
1. Splitter Control Button

Fig. 8.8, Fuller 18-Speed RTO Model Transmissions Shift Pattern

Depress the clutch to the floor, shift into low; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving.

To shift from low direct to low overdrive, move the splitter control button (**Fig. 8.8**) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

5. For 13-speed transmissions:

   Shift upward from low to 1st gear, 2nd, etc. until 4th gear, double-clutching between shifts, and accelerating to 80 percent of engine governed speed. See **Fig. 8.7**.

   For 18-speed transmissions:

   Shift upward from low overdrive to 1st direct by first moving the splitter control button into the direct (rearward) position (**Fig. 8.8**). Move the shift lever, double-clutching, to the 1st gear position.

   Continue upshifting through the shift pattern. Double-clutch during lever shifts (1st to 2nd to 3rd to 4th); single-clutch during split shifts (1st direct to 1st overdrive, etc.).

6. When in 4th gear (13-speed transmissions) or 4th overdrive (18-speed transmissions) and ready to shift up to 5th gear, use the range shift lever as follows:

   For 13-speed transmissions:

   While in 4th gear, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral. Then, disengage the clutch; double-clutch through neutral; move the shift lever to 5th gear; engage the clutch, and accelerate the engine.

   For 18-speed transmissions:

   While in 4th overdrive, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral.

   Move the shift lever, double-clutching, to the 5th gear position. Just before making final clutch engagement, move the splitter control button to the direct (rearward) position; then engage the clutch and accelerate. Do not move the control button while the shift lever is in neutral.

7. Shift up through the high range gears as follows:

   For 13-speed transmissions:

   To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.7**) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

   Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

   For 18-speed transmissions:

   To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.8**) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

   Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button to the direct (rearward) position; then, immediately release the accelerator, and disengage the clutch. Engage the clutch, and accelerate the engine only after the transmission has shifted.

2. Start the downshift from 8th direct to 7th overdrive by flipping the splitter control button to the overdrive (forward) position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Shift downward through each of the high range gears, alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct and ready for the downshift to 4th (13-speed transmissions) or 4th overdrive (18-speed transmissions), push the range preselection lever down. Then, double-clutch through neutral and move the shift lever to the 4th gear position. On 18-speed transmissions, move the splitter control button to the overdrive (forward) position *before* engaging the clutch. Do not move the control button while the shift lever is in neutral.
5. Continue downshifting from 4th to 1st as follows:

   For 13-speed transmissions:

   Downshift through the low range gears as conditions require. Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

   For 18-speed transmissions:

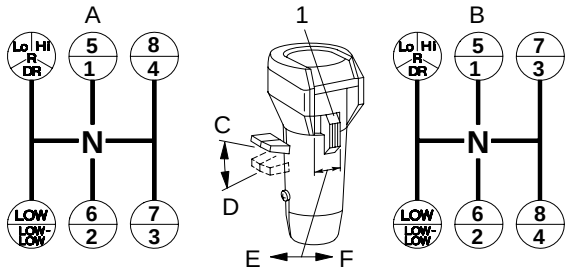
   Continue downshifting from 4th overdrive to 4th direct, then 4th direct to 3rd overdrive, 3rd overdrive to 3rd direct, etc. Single-clutch when split shifting (direct to overdrive, overdrive to direct). Double-clutch when making lever shifts (4th to 3rd, 3rd to 2nd, etc.).

Fuller Deep-Reduction and Range-Shift Models

General Information

10-Speed RT, RTO and RTX Models

Fuller RT–7608LL, RT–8908LL, RTO–11708LL, RTO–11908LL, RTO–14708LL, RTO–14908LL, RTX–11708LL, and RTX–14708LL transmissions have a 5-speed front section, and a 2-speed rear-range section, with a deep reduction gear. The low-low, deep reduction gear is used only when operating under adverse conditions. Low gear in the front section is used only for rough, off-highway conditions, as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. See **Fig. 8.9** for the shift pattern, noting that the 3rd/7th and 4th/8th shift positions in the RT and RTX-LL transmissions are opposite of the RTO-LL transmissions.



03/13/96 f260026a

A. All RTO Transmissions
B. All RT and RTX Transmissions
C. High Range
D. Low Range
E. Deep Reduction IN (forward)
F. Deep Reduction OUT (rearward)
1. Deep Reduction Button

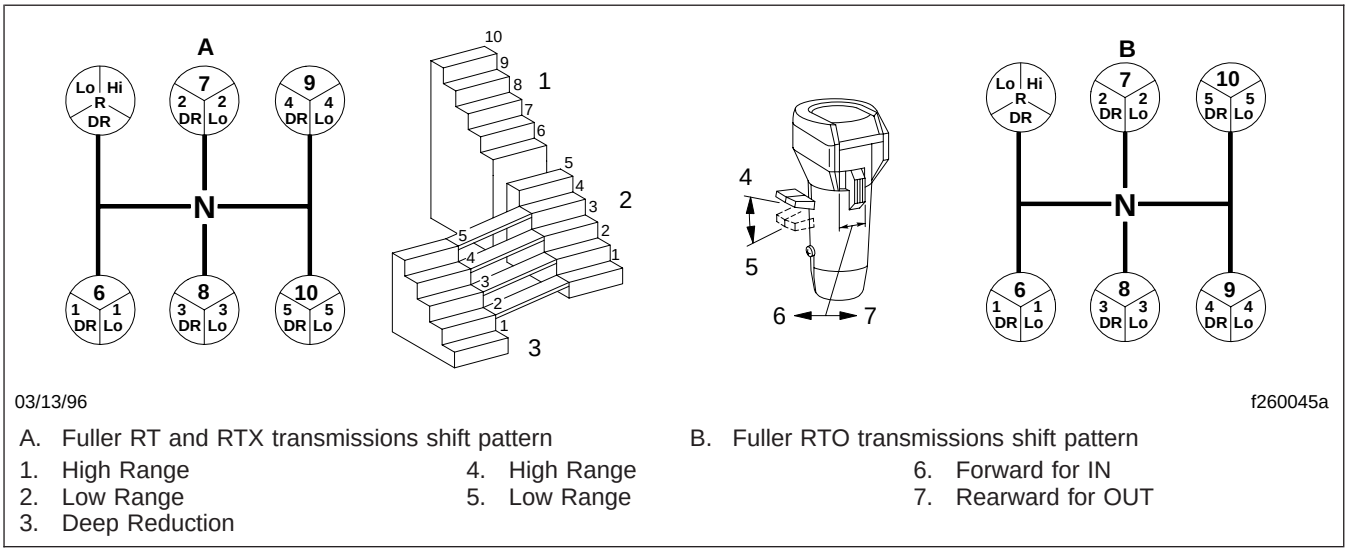
Fig. 8.9, Fuller 10-Speed RT, RTO and RTX Model Transmissions Shift Patterns

15-Speed RT, RTO, and RTX Models

Fuller RT–14715, RT–14915B, RT–15715, RTO–14715, RTO–14915B, RTO–15715, RTO–16915B, RTX–14715, and RTX–15715 transmissions have a 5-speed front section, and a 2-speed rear, range section. They also have five additional deep reduction ratios. The 5-speed front section, and the low- and high-range sections provide ten evenly and progressively spaced forward speeds. The five deep reduction ratios are also evenly and progressively spaced; however, they do overlap the low-range ratios, and should be used only when operating under adverse conditions. See **Fig. 8.10** for the shift patterns, noting that the 4th/9th, and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation

IMPORTANT: The shifter knob has an interlock feature that prevents the deep reduction button from being moved forward when the range preselection lever is up (in high range); when in low range and the deep reduction button is in the forward position, the range preselection lever cannot be moved up.



A. Fuller RT and RTX transmissions shift pattern

1. High Range
2. Low Range
3. Deep Reduction
4. High Range
5. Low Range

B. Fuller RTO transmissions shift pattern

6. Forward for IN
7. Rearward for OUT

Fig. 8.10, Fuller 15-Speed RT, RTO and RTX Model Transmissions Shift Patterns

1. For all driving conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling, and without slipping the clutch excessively.
2. Use the clutch brake to stop gear rotation when shifting into low-low, low-1st (whichever is used as a starting ratio) or reverse, when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

   For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Use double-clutching between all upshifts and downshifts.
4. Never move the shift lever into low gear while in high range.
5. Do not preselect with the deep reduction button. When making the shift from a deep reduction ratio to a low-range ratio, move the deep reduction button from a forward position to a rearward position, then complete the shift immediately.
6. Never move the deep reduction button from a rearward position to a forward position when the transmission is in high range.
7. Do not shift from high range to low range at high vehicle speeds.
8. Do not make range shifts with the vehicle moving in reverse gear.
9. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
10. After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

There are several patterns of upshifting, depending on the vehicle load and the road conditions. See **Table 8.2** for suggested shifting sequences. Deep reduction gears are best suited for heavy loads and steep inclines. Low gear (in 10-speed transmissions) is best suited for off-highway use.

The following instructions are recommended for starting a loaded vehicle moving, under adverse conditions.

1. Position the gear shift lever in neutral. Start the engine, and bring the vehicle air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range.

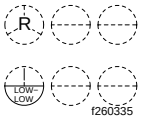
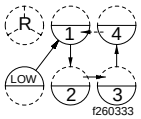
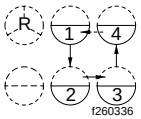
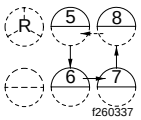
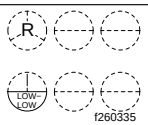
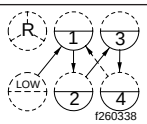
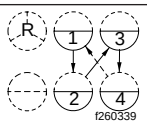
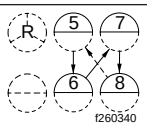
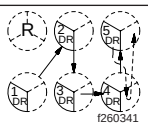
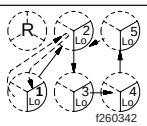
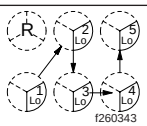
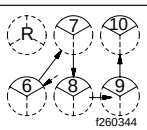
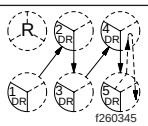
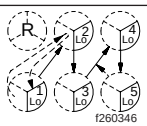
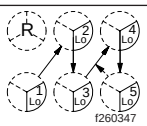
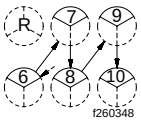
Fuller Shift Progressions				
TRANSMISSION MODEL	DEEP REDUCTION	LOW RANGE		HIGH RANGE
	Adverse Conditions Only	Off-Highway and Adverse Conditions	On-Highway and Ideal Conditions	All Conditions
10-Speed RTO	 f260335	 f260333	 f260336	 f260337
10-Speed RTX	 f260335	 f260338	 f260339	 f260340
15-Speed RTO	 f260341	 f260342	 f260343	 f260344
15-Speed RT and RTX	 f260345	 f260346	 f260347	 f260348

Table 8.2, Fuller Shift Progressions

3. Move the deep reduction button to the forward position, to engage the deep reduction gears.
4. Depress the clutch pedal to the floor; shift into low-low gear (10-speed transmissions) or 1st gear of deep reduction (15-speed transmissions); then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
5. For 10-speed transmissions:

   When ready for the next upshift, move the deep reduction button rearward, then break torque by momentarily releasing the accelerator or depressing the clutch pedal. Do not move the shift lever.

   For 15-speed transmissions:

   Shift upward from 1st gear of deep reduction to 5th gear of deep reduction, double-clutching between shifts and accelerating to 80 percent of engine governed speed. See **Table 8.2.**

   When ready for the next upshift, move the deep reduction button from the forward position to the rearward position, then double-clutch through neutral, and move the shift lever to the 4th gear position in the low range.
6. Shift upward from low gear (10-speed transmissions) or 4th gear (15-speed transmissions), to the top gear in low range (see **Table 8.2**), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
7. While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral, and shift into the bottom gear in high range (see **Table 8.2**). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
8. With the transmission in high range, shift progressively upward through each of the high range gears (see **Table 8.2**), double-clutching between shifts.

Alternate Upshifting Procedures (15-Speed Transmissions Only)

The shift from deep reduction to low range can also be made from 2nd, 3rd, or 4th gear of deep reduction, but must be made to the next gear lower in the low range. The shift from 2nd gear of deep reduction

to 1st gear in low range (or 3rd gear of deep reduction to 2nd gear in low range, and 4th gear of deep reduction to 3rd gear in low range), is an upshift, and the same procedure should be followed as that shown for shifting from 5th gear of deep reduction to 4th gear in low range. See step 5, under "Upshifting."

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears, as conditions require.

   Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Meritor Range-Shift Models

General Information

9-Speed RM, RMO, and RMX Models

Meritor RM9–115A, RM9–125A, RM9–135A, RM9–145A, RM9–155A, RMO9–115B, RMO9–125A/B, RMO9–135A/B, RMO9–145A/B, RMX9–115B, RMX9–125A/B, RMX9–135A/B, RMX9–145A/B, RMX9–155B, RMX9–115R, RMX9–125R, RMX9–135R, and RMX9–145R transmissions have a 5-speed front section, and a 2-speed auxiliary section. The low gear in the front sections of the "A" and "B" ratio transmissions is used only as a starting ratio. The high gear in the front section of the "R" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range. See **Fig. 8.11** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RM and RMX (direct ratio) are opposite of the RMO (overdrive ratio) transmissions. The RMX-R ratio transmissions have the 1st/5th shift positions where low is in the A and B ratio transmissions. The top gear in the RMX-R ratio transmissions is called 9th gear.

10-Speed RM and RMX Models

Meritor RM10–115A, RM10–125A, RM10–135A, RM10–145A, RMX10–115A, RMX10–125A, RMX10–135A, RMX10–145A, RMX10–155A and RMX10–165A transmissions have ten evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed auxiliary section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range; the second time in high range. See **Fig. 8.12** for the shift pattern.

Operation

Reverse

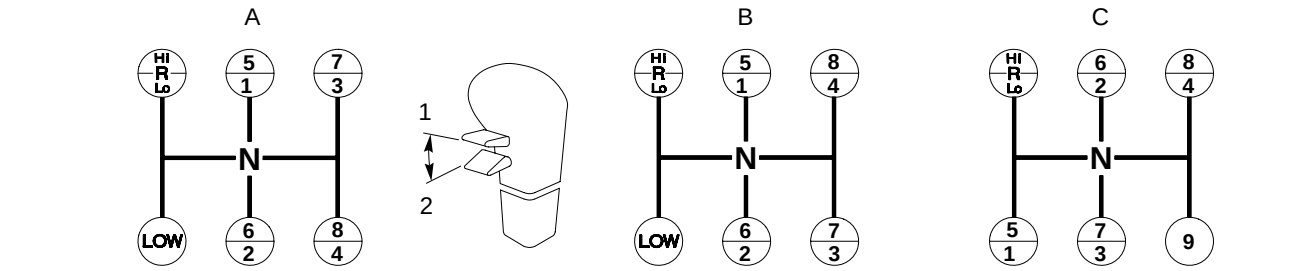
To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into reverse.

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

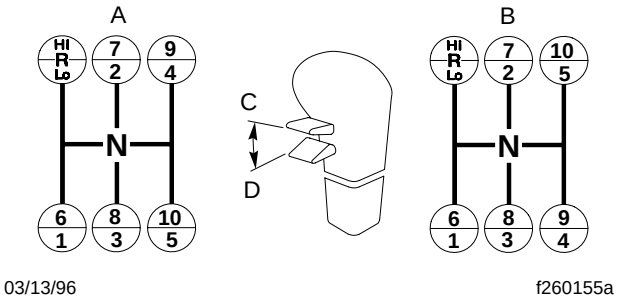
1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.

   Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement; holding the clutch pedal at the bottom of travel, shift into low.
2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the clutch pedal, and move the shift lever into neutral.
4. Release the clutch, and allow the engine to decelerate until the road speed and the engine rpm match.
5. Partially depress the clutch pedal, and move the shift lever into first gear.
6. Double-clutch and continue upshifting until you reach the top gear in the low range, 4th gear in



A. All RM and RMX Transmissions
B. All RMO Transmissions
C. All RMX-R Transmissions
1. High Range
2. Low Range

Fig. 8.11, Meritor 9-Speed RM, RMO and RMX Model Transmissions Shift Patterns



A. All RM and RMX Transmissions
B. All RMO Transmissions
C. High Range
D. Low Range

Fig. 8.12, Meritor 10-Speed RM, RMO and RMX Model Transmissions Shift Patterns

9-speed models and 5th gear in 10-speed models. See **Table 8.3**.

7. To upshift into high range–with the transmission still in the highest low-range gear–move the range selector lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
8. Release the clutch pedal, and let the engine slow until the road speed and engine rpm match.
9. Partially depress the clutch pedal and move the shift lever into the lowest gear in the high range, 5th gear in 9-speed models and 6th gear in 10-speed models.
10. Double-clutch to continue upshifting.

Meritor Shift Progressions

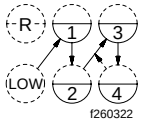
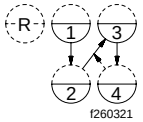
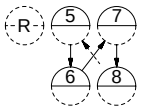
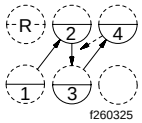
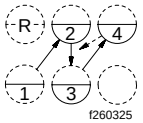
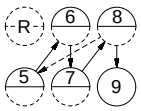
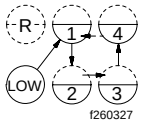
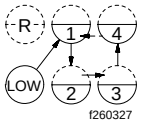
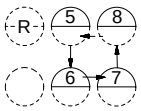
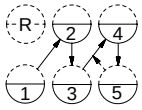
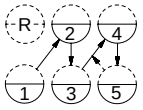
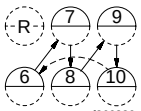
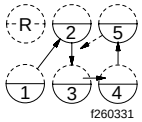
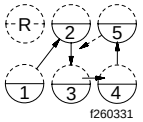
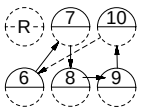
TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
9-Speed Direct or Overdrive (RM or RMX)	 f260322	 f260321	 f260320
9-Speed Direct (RMX-R)	 f260325	 f260325	 f260326
9-Speed Overdrive (RMO)	 f260327	 f260327	 f260328
10-Speed Direct or Overdrive (RM or RMX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RMO)	 f260331	 f260331	 f260332

Table 8.3, Meritor Shift Progressions

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, 5th gear in 9-speed models and 6th gear

in 10-speed models. Double-clutch between shifts. See **Table 8.3**.

2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

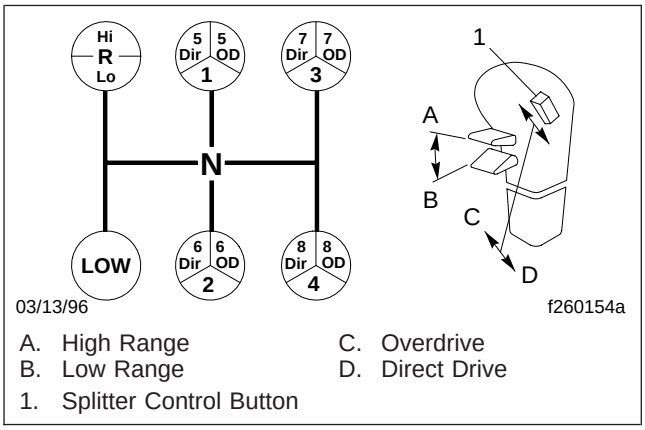
   Never fully depress the clutch pedal to use the clutch brake when downshifting, or as a brake to slow the vehicle.

Meritor Splitter and Range-Shift Models

General Information

13-Speed RMO Models

The Meritor RMO13–145A transmission has thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See **Fig. 8.13**.



A. High Range
B. Low Range
C. Overdrive
D. Direct Drive
1. Splitter Control Button

Fig. 8.13, Meritor 13-Speed RMO Model Transmission Shift Pattern

All of the thirteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range selection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high-range gear positions can be split with the overdrive ratio of the splitter gear. Ratios cannot be split while the transmission is in low range.

Operation

IMPORTANT: The shifter knob has an interlock feature that prevents the splitter control button from being moved up when the range selection lever is down (in the low range); when the transmission is in the high range, and the splitter control button is up, the range selection lever cannot be moved down.

Reverse

To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement; holding the clutch pedal at the bottom of travel, shift into reverse.

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.

   Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement; holding the clutch pedal at the bottom of travel, shift into low.
2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the clutch pedal, and move the shift lever into neutral.

4. Release the clutch pedal, and allow the engine to decelerate until the road speed and the engine rpm match.
5. Partially depress the clutch pedal, and move the shift lever into 1st gear.
6. Double-clutch to continue upshifting until in fourth gear. See **Table 8.3**.
7. To upshift into high range—with the transmission still in 4th gear—push the range selection lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
8. Release the clutch pedal, and let the engine slow until the road speed and engine rpm match.
9. Partially disengage the clutch, and move the shift lever into 5th gear.
10. To upshift from 5th gear into 5th overdrive, flip the splitter control button up to the overdrive position; then, immediately release the accelerator, and press and release the clutch pedal. It is not necessary to move the shift lever when shifting from direct to overdrive; the transmission will shift when synchronization with the engine's speed is reached. Accelerate the engine only after the transmission has shifted.
11. To shift from 5th overdrive to 6th direct, partially disengage the clutch, shift into 6th—but before engaging the clutch—flip the splitter control button down into the direct drive position; then engage the clutch, and accelerate the engine.

    Do not move the control button while the shift lever is in neutral.
12. Shift upward through each of the high range gears, alternating the procedures in steps 10 and 11 above.

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button down to the direct drive position; then, immediately release the accelerator, and press and release the clutch pedal. Accelerate the engine only after the transmission has shifted.
2. To downshift from 8th direct to 7th overdrive, flip the splitter control button up to the overdrive position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Downshift through each of the high range gears alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into 4th gear. See **Fig. 8.13**. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
5. With the transmission in low range, downshift through the low range gears as conditions require.

   Never fully depress the clutch pedal to use the clutch brake when downshifting, or as a brake to slow the vehicle.

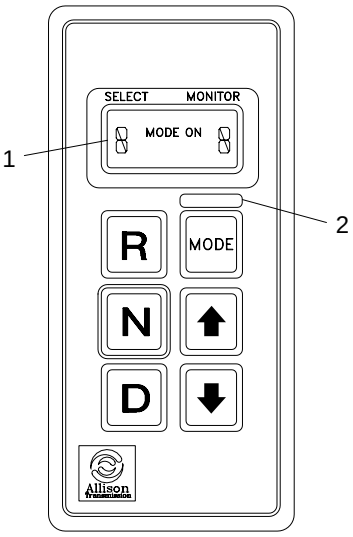
Allison Automatic Models

General Information

HD-series automatic transmissions have six forward speeds and one reverse speed. See **Fig. 8.14**. These transmissions have electronic shift controls that can be programmed to allow the use of different numbers of geared speeds. For instance, the transmission can be programmed to operate as a 4-speed, 5-speed, or 6-speed unit in the "primary" shift mode. If needed, a "secondary" shift mode can be programmed to provide another shift configuration to optimize vehicle use under different operating conditions. To activate a secondary shift mode, or other special function programmed into the electronic control unit (ECU), depress the Mode button. "Mode On" is displayed in the indicator panel just above the push buttons. A label just above the Mode button identifies the special function.

NOTE: Each time a push button is depressed on the shift selector, a short beep will be heard. This indicates that the ECU has received input to change operation.

The HD-series transmission system is designed to warn the driver of transmission malfunctions. The driver of a vehicle equipped with these transmissions



1. Indicator Panel 2. Mode ID

Fig. 8.14, Allison Push Button Shift Selector

should know the extent of the warning system in order to safely operate the vehicle. See **Chapter 2** for information on the warning system.

Operation

CAUTION

The engine should never be operated for more than 30 seconds at full throttle with the transmission in gear and the output stalled. Prolonged operation of this type will overheat the transmission fluid and will result in severe damage to the transmission.

1. Start the engine, then check the digital display on the "push button shift selector." Under "Select" at the top of the unit, the display should always show the "primary" shift mode. Under "Monitor," the gear the transmission is in should be displayed.

WARNING

Never shift from neutral (N) to drive (D) or reverse (R) at engine speeds above idle. The vehicle will lurch forward or backward, which could cause property damage and personal injury.

2. Use reverse (R) to back the vehicle. Completely stop the vehicle before shifting from a forward gear to reverse or from reverse to forward. There is only one reverse gear.
3. Select drive (D) for all normal driving conditions. The vehicle will start out in 1st gear, and as speed increases, the transmission will upshift through each gear automatically. As the vehicle slows down, the transmission will downshift to the correct gear automatically.

   The pressure of your foot on the accelerator pedal influences the automatic shifting. When the pedal is fully depressed, the transmission will automatically upshift near the governed speed of the engine. A partially depressed position of the pedal will cause the upshifts to occur at a lower engine speed.
4. Occasionally the road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. The lower the gear range, the greater the engine braking power.

   Use the up or down arrow buttons on the shift selector to reach the desired gear. The "Select" indicator will display your choice, and the "Monitor" indicator will show the selected gear once it is reached.

NOTE: In the lower gear ranges, the transmission will not upshift above the highest gear selected unless the engine governed speed is exceeded.

5. Use neutral (N) and apply the parking brake when the vehicle is parked with the engine running.

CAUTION

Do not allow the vehicle to coast in neutral. This can result in severe transmission damage. Also, no engine braking is available.

Meritor Engine Synchro Shift™ (ESS) Automated Models

General Information

9–Speed and 10–Speed M, MO, RS, and RSX Models

Meritor 9-speed M–11F9A–E11, M–12F9A–E12, M–13F9A–E13, M–14F9A–E14, M–15F9A–E15, MO–12F9A–E12, MO–13F9A–E13, MO–14F9A–E14, MO–11F9B–E11, MO–12F9B–E12, MO–13F9B–E13, MO–14F9B–E14, MO–15F9B–E15, RS9–115A, RS9–125A, RS9–135A, RS9–145A, RS9–155A, RSX9–115B, RSX9–115R, RSX9–125A, RSX9–125B, RSX9–125R, RSX9–135A, RSX9–135B, RSX9–135R, RSX9–145A, RSX9–145B, RSX9–145R, RSX9–155B, and 10-speed M–11F10A–E11, M–12F10A–E12, M–13F10A–E13, M–14F10A–E14, M–15F10A–E15, MO–11F10A–E11, MO–12F10A–E12, MO–13F10A–E13, MO–14F10A–E14, MO–15F10A–E15, MO–16F10A–E16, MO–11F10C–E11, MO–12F10C–E12, MO–13F10C–E13, MO–14F10C–E14, MO–15F10C–E15, MO–16F10C–E16, M–14F10A–E16, MO–14F10A–E16, MO–14F10C–E16, MO–16F10C–E18, RS10–115A, RS10–125A, RS10–135A, RS10–145A, RSX10–115A, RSX10–115C, RSX10–125A, RSX10–125C, RSX10–135A, RSX10–135C, RSX10–145A, RSX10–145C, RSX10–155A, RSX10–155C, RSX10–165A, and RSX10–165C transmissions do not require use of the clutch except to start and stop the vehicle.

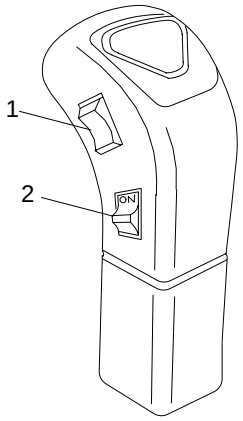
NOTE: Meritor M and MO series ESS transmissions are available only on vehicles equipped with either Caterpillar or Cummins electronic engines. Meritor RS and RSX series ESS transmissions are only available on vehicles equipped with Detroit Diesel electronic engines.

The ESS system works with the engine fuel control system to automatically synchronize engine rpm to road speed during gear changes. Use the clutch only to start and stop the vehicle and to shift into forward or reverse. The HI and LO ranges are automated, so the driver does not have to select ranges. A "break torque" feature allows the driver to move the shift lever and take the transmission out of gear without changing throttle position. Throttle position can be maintained while braking and downshifting through the gears when stopping the vehicle, as well as on steep grades.

The major components of the ESS system are the system switch, shift-intent switch, input and output shaft speed sensors, a neutral position sensor, and an electro-pneumatic solenoid.

Operation

The ESS system collects and relays information pertaining to the positions of the shift-intent and system switches (**Fig. 8.15**), transmission input and output shaft speeds, and shift lever position. The information is received by the engine Electronic Control Module (ECM), which signals the fuel control system to increase or decrease engine rpm to match road speed. The ECM also controls HI and LO range selection in the auxiliary case on the rear of the transmission.



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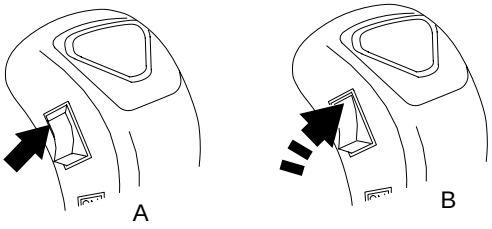
1. Shift-Intent Switch 2. System Switch

Fig. 8.15, ESS Shift Handle

The system switch (**Fig. 8.15**) is the lower switch located on the driver's side of the shift handle. It controls ESS system operation. When in the down position, the system is operating and the word ON is visible on the switch. In the up position, the word OFF is visible, the system is not operating, and the transmission can be shifted manually.

The shift-intent switch (**Fig. 8.15**) is the upper switch on the driver's side of the shift handle. It has four positions and controls upshifting and downshifting by communicating to the ECM the driver's intention of changing gears.

NOTE: If the system switch is OFF, use the shift-intent switch to select between ranges. Push the top of the switch (**Fig. 8.16**) to select the HI range on upshifts and the bottom of the switch (**Fig. 8.17**) to select the LO range on downshifts.



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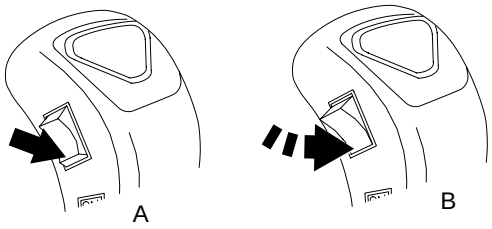
A. Press the top portion (engage the first position) of the shift-intent switch to begin an upshift.
B. Press the top portion again (engage the second position) to break torque.

Fig. 8.16, ESS Upshifting Using the Shift-Intent Switch



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A. Press the bottom portion (engage the first position) of the shift-intent switch to begin a downshift.
B. Press the bottom portion again (engage the second position) to break torque.

Fig. 8.17, ESS Downshifting Using the Shift-Intent Switch

⚠ WARNING

Make sure that the transmission is in neutral (N) when you start the vehicle. If the vehicle is started in gear, it will suddenly move forward or backward which could result in personal injury and damage to property and the transmission.

Starting the Vehicle

1. Ensure that the shift lever is in the neutral (N) position.
2. Push the clutch pedal to the bottom of its travel to engage the clutch brake.
3. Start the engine.
4. Slowly release the clutch pedal.
5. Allow the system air to build up to the range specified on the gauge.
6. Release the parking brake.

Shifting Into a Starting Gear

⚠ CAUTION

Always use the proper starting gear. Do not shift into neutral and coast, as this will result in damage to the transmission.

1. Press the system switch down, into the ON position, to activate the ESS system.
2. Press the top portion of the shift-intent switch.

IMPORTANT: Use the clutch brake only when initially engaging a gear with the vehicle standing still.

3. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.
4. Move the shift lever and engage a starting gear.
5. Slowly release the clutch pedal.

NOTE: If you do not shift the transmission out of neutral into a gear within two seconds, the ESS system will "time out" and deactivate. The transmission returns to manual operation. To reactivate the ESS system, press the shift-intent switch again. See the following procedures for upshifting and downshifting for instructions on how to use the shift-intent switch.

Upshifting

1. To upshift into the next higher gear:
   - 1.1 Press the top portion of the shift-intent switch.
   - 1.2 Apply pressure with the shift lever toward the neutral position.

1.3 Press the top portion of the shift-intent switch again, far enough so that the switch goes into a second position inside the body of the shift handle. Then release the switch. See **Fig. 8.16**. This will break torque.

1.4 Immediately move the shift lever to the neutral position.

1.5 Allow engine rpm to slow down enough to synchronize with road speed.

1.6 Move the shift lever to the next higher gear.

2. To upshift through the rest of the gears, repeat the substeps above. Before each upshift, push the top of the shift-intent switch into the shift handle body to break torque. The range shift is automatic.

3. To skip a gear, press the shift-intent switch into the shift handle body, while in neutral, one time for every gear that is skipped.

Downshifting

1. To downshift into the next lower gear.

1.1 Press the bottom portion of the shift-intent switch.

1.2 Apply pressure with the shift lever toward the neutral position.

1.3 Press the bottom portion of the shift-intent switch again, far enough so that the switch goes into a second position inside the body of the shift knob. Then release the switch. See **Fig. 8.17**. This will break torque.

1.4 Immediately move the shift lever to the neutral position.

1.5 Allow engine rpm to speed up enough to synchronize with road speed.

1.6 Move the shift lever to the next lower gear.

2. To downshift through the rest of the gears, repeat the substeps above. Before each downshift, push the bottom of the shift-intent switch into the shift handle body to break torque. The range shift is automatic.

3. To skip a gear, press the shift-intent switch into the shift handle, while in neutral, one time for every gear that is skipped.

Reverse

1. Press the system switch on the shift handle so that it is in the ON position and the ESS system is activated.

2. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.

3. Move the shift lever and engage reverse.

4. Slowly release the clutch pedal and move the vehicle in the reverse direction.

NOTE: If a HI reverse range is required, follow the steps below.

5. Press the system switch on the shift handle so that it is in the OFF position and the ESS system is deactivated.

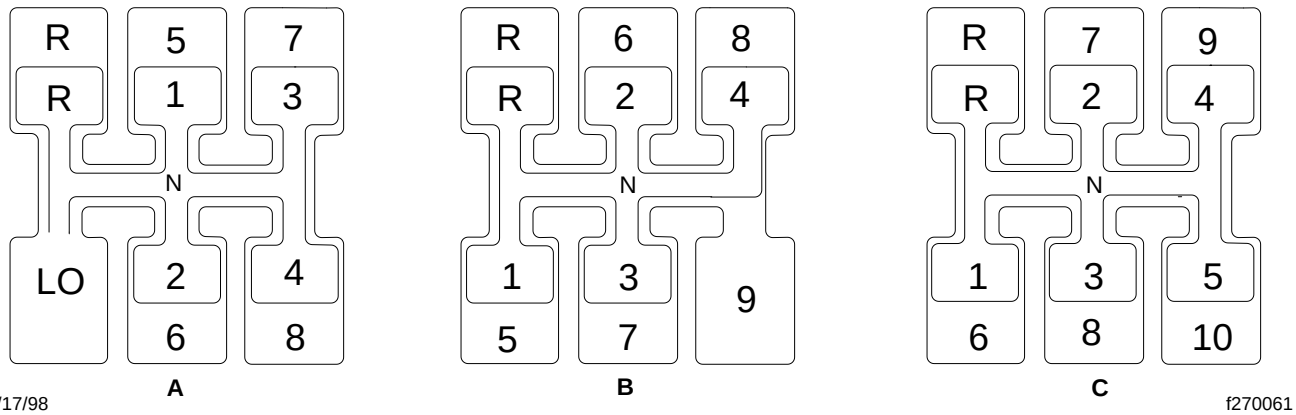
6. Press the top portion of the shift-intent switch to engage the HI range.

7. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.

8. Move the shift lever and engage reverse.

9. Slowly release the clutch pedal and move the vehicle in the reverse direction.

See **Fig. 8.18** for two ESS 9-speed shift patterns and one ESS 10-speed shift pattern.



A. 9-Speed Shift Pattern with LO Gear

B. 9-Speed Shift Pattern

C. 10-Speed Shift Pattern

Fig. 8.18, Meritor ESS 9- and 10-Speed Shift Patterns

9

Rear Axles

Meritor Single Drive Axles with Traction Equalizer 9.1
Meritor Drive Axles with Main Differential Lock 9.1
Meritor Main Differential Lock Operation 9.1
Meritor Tandem Drive Axles with Interaxle Differential 9.2
Meritor Interaxle Differential Lockout Operation 9.2
Eaton Single Reduction Axles with Controlled Traction Differential 9.2
Eaton 2-Speed Tandem Axles 9.3
Eaton Interaxle Differential Lockout Operation 9.3

Meritor Single Drive Axles with Traction Equalizer

Some Meritor single drive axles are equipped with a traction equalizer which is a load sensing, self-actuating feature. A traction equalizer provides normal differential action where traction is good. When one wheel begins to spin faster than the other, clutch plates in the differential housing automatically engage, delivering power to both wheels. There is no operator control with this feature.

A traction equalizer occasionally tends to slip in a jerking motion, producing irregular intervals of sharp noises. This generally occurs when the vehicle is operating at low speeds on fairly sharp turns. This condition, called slip-stick, is corrected by adding a friction modifier to the axle lubricant. This additive tends to reduce the static coefficient of friction to a value equal to, or lower than, the sliding coefficient.

Refer to the vehicle maintenance manual for additional information on friction modifiers and when to add them to axle lubricants.

⚠ CAUTION

Tire sizes on both rear wheels should be the same on axles equipped with a traction equalizer. If not, excessive wear may occur in the traction equalizer.

Meritor Drive Axles with Main Differential Lock

The Meritor main differential lock is a driver-controlled traction device operated from the vehicle cab. A switch allows the driver to lock or unlock the differential. An indicator light comes on when the differential lock is engaged. An optional buzzer can also be used to indicate differential lock engagement.

The main differential lock provides maximum traction under slippery conditions. When the differential lock is engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together, maximizing traction of both wheels and protecting against spinout. Under normal traction conditions, do not engage the differential lock. Operate the axle with differential action between both wheels.

⚠ WARNING

Be especially careful when driving under slippery conditions with the differential locked. Though forward traction is improved, the vehicle can still slip sideways, causing possible loss of vehicle control, personal injury, and property damage.

Meritor Main Differential Lock Operation

To lock the main differential and obtain maximum traction under slippery conditions, move the control switch to the lock position.

⚠ WARNING

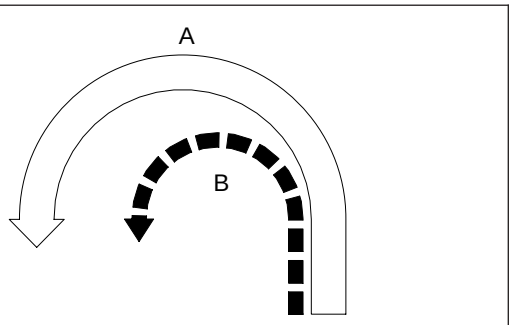
Lock the main differential only when the vehicle is standing still or moving less than 25 mph (40 km/h). Never lock the main differential when the vehicle is traveling down steep grades or when the wheels are slipping. This could damage the differential or lead to loss of vehicle control, causing personal injury and property damage.

NOTE: On some vehicles, the differential lock system is connected through the low speed range of the transmission. If this system is used, the transmission must be in the low speed range for the differential to fully lock.

If the vehicle is moving, maintain a constant vehicle speed while engaging the differential lock. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully lock. The indicator light should come on and the buzzer should sound on vehicles so equipped. When the differential is fully locked, the turning radius will increase because the vehicle understeers. See **Fig. 9.1**. Drive cautiously and do not exceed 25 mph (40 km/h).

To unlock the main differential, move the control switch to the unlock position. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully unlock.

NOTE: If the differential lock system is connected through the low speed range of the transmission, shifting out of low speed range will also unlock the differential.



A. Turning Radius When Differential is Locked (engaged)–Understeer Condition
B. Turning Radius When Differential is Unlocked (disengaged)

Fig. 9.1, Turning Radius

When the differential lock disengages, the indicator light will go off and the buzzer will stop.

Meritor Tandem Drive Axles with Interaxle Differential

Meritor tandem drive axles with an interaxle differential have a lockout feature. Differential lockout is controlled by a switch (**Fig. 9.2**) on the control panel.

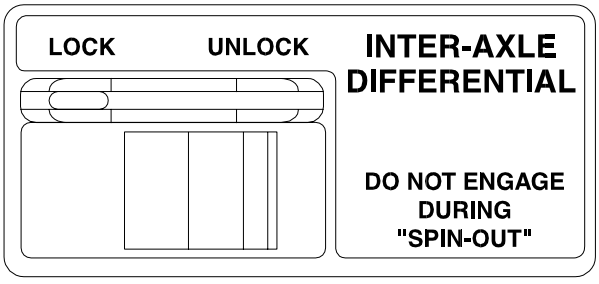


Fig. 9.2, Interaxle Differential Control

In the UNLOCK position, there is differential action between the two axles. The differential compensates for different wheel speeds and variations in tire size. Keep the interaxle differential unlocked for normal driving on roads where traction is good.

In the LOCK position, the interaxle differential is locked out and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is also transmitted straight through to the rear axle, so both axles turn together at the same speed. The LOCK position should be used when the vehicle encounters poor traction conditions; however, it also increases drivetrain and tire wear and should be used only when improved traction is required.

Meritor Interaxle Differential Lockout Operation

To lock the interaxle differential and achieve maximum pulling power when approaching slippery or poor road conditions, move the lockout control valve to LOCK while maintaining vehicle speed, before encountering the poor road conditions. Let up momentarily on the accelerator to engage the differential lock. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before locking the interaxle differential.

⚠ CAUTION

Do not actuate the interaxle differential control valve while the tires are slipping. Do not operate the vehicle continuously with the interaxle differential locked during extended good road conditions. To do so could result in damage to the axle gearing and excessive tire wear.

To unlock the interaxle differential, move the lockout control valve to UNLOCK while maintaining vehicle speed, after leaving the poor road conditions. Let up momentarily on the accelerator to allow the shift, then resume driving at normal speed.

Eaton Single Reduction Axles with Controlled Traction Differential

The controlled traction differential system is a differential assembly designed to transfer torque from the slipping wheel to the one with traction.

A control valve (**Fig. 9.3**) in the cab is actuated by the driver to engage and disengage the controlled traction feature.

Disengaged, the axle has differential action all the time. One wheel will spin independently of the other, if slippery conditions are encountered.

Engaged, wheel slippage and spinout are minimized.

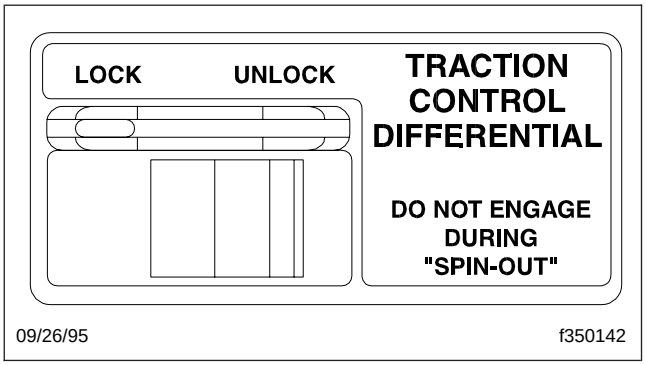


Fig. 9.3, Traction Control Differential Control

NOTE: The controlled traction differential can be engaged at any speed, except during spinout.

Eaton 2-Speed Tandem Axles

Each axle of the 2-speed tandem contains a high range single reduction gear set and a low range double reduction gear set. The operator selects the desired axle range by moving the range preselection lever located on the shifter knob. See **Fig. 9.4**.

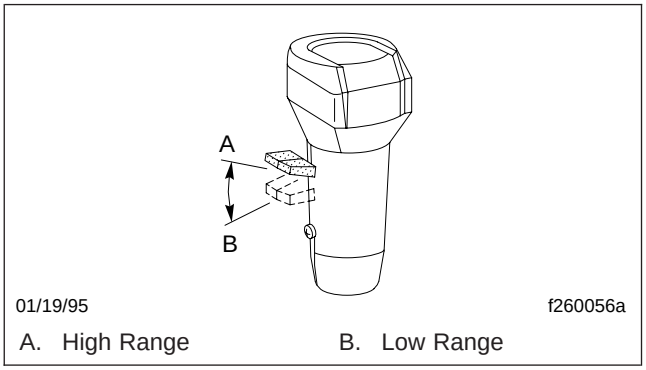


Fig. 9.4, Range Preselection Lever

Dual Range 2-Speed Tandem Axle Operation with Multispeed Transmissions

NOTE: Refer to **Chapter 8**, "Transmissions," for detailed information on how to use the range preselection lever.

On multispeed transmission applications, the 2-speed axle should be used as a dual range. Use the low range when operating off-highway or when starting out with a heavy load on-highway. After the vehicle is moving on the highway, the axle can be shifted to high range.

To shift the axle to the high range: Make sure the interaxle differential lockout is disengaged; keep the throttle pedal down; move the range preselection lever to high; release the throttle pedal until the axle shifts; then accelerate.

To shift the axle to the low range: Keep the throttle pedal down; move the range preselection lever to low; release and depress the throttle pedal quickly to increase engine rpm. The axle will shift to low range.

NOTE: When parking the vehicle, put the axle in the low range with the engine running. Engage the clutch and transmission to be sure the axle has completed the shift into the low range. Some vehicle motion is required to ensure engagement of the axle.

IMPORTANT: Refer to "Eaton Interaxle Differential Lockout Operation" for precautions that must be taken when shifting axles in relation to the interaxle differential lockout.

Eaton Interaxle Differential Lockout Operation

Interaxle differential lockout systems include a lockout control valve (**Fig. 9.2**) located in the cab, and an air-operated shift unit mounted on the forward rear axle.

When the interaxle differential lockout control valve is in the LOCK position, the interaxle differential is locked out and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is also transmitted straight through to the rear axle, so both axles turn together at the same speed. The LOCK position should be used when additional traction is needed.

⚠ CAUTION

Engage the lockout only when stopped or at slow speeds and never when the wheels are spinning. Do not operate the axles on dry pavement with the lockout engaged for prolonged periods. Use only when additional traction is needed under adverse road conditions. Disengage the interaxle differential lockout before shifting the axle to a higher range.

When the interaxle differential lockout control valve is in the UNLOCK position, the interaxle differential allows differential action between the axles thereby compensating for different wheel speeds and variations in tire size. Keep the interaxle differential lockout in the UNLOCK position for normal driving on roads where traction is good. On 2-speed axles, the interaxle differential must be in the UNLOCK position before attempting to shift the axles out of low or high range.

10

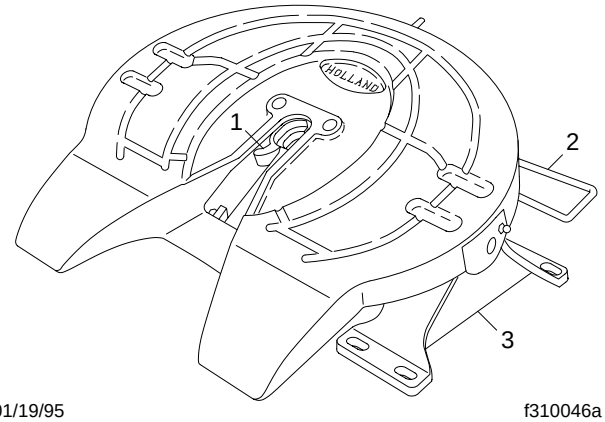
Fifth Wheels and Trailer Couplings

Holland Fifth Wheels 10.1
ASF Castloc® II and Simplex® Series Fifth Wheels 10.6
Fontaine Fifth Wheels 10.11
Premier Trailer Couplings 10.15
Holland Trailer Coupling 10.17

Holland Fifth Wheels

General Information

The 2535 sliding fifth wheel models incorporate a Model 3500 fifth wheel (**Fig. 10.1**), equipped with either an air-operated release slide, or a manual release slide. Sliding fifth wheel assemblies are mounted on a baseplate which permits forward and rear movement along notched rails. Plungers are meshed into teeth on the baseplate to lock the sliding mechanism. Disengagement of the sliding member is accomplished when the plungers are withdrawn (manually or air-operated), releasing the fifth wheel assembly so that it can be positioned for optimum weight distribution over the tractor axles.



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1. Kingpin Lock Mechanism
2. Kingpin Control Handle
3. Mounting Bracket

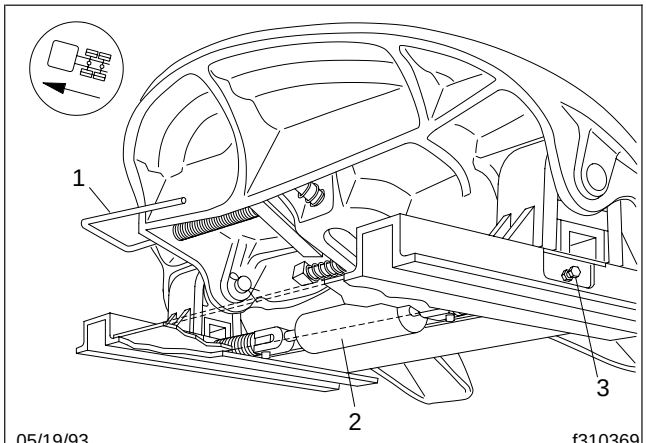
Fig. 10.1, Holland Fifth Wheel

The air-operated release slide assembly (**Fig. 10.2**) contains a double-ended air cylinder which locks and unlocks both sides of the sliding member at the same time. The air cylinder is activated by a two-position air-control valve in the tractor cab.

The manual release slide assembly (**Fig. 10.3**) is equipped with a single release lever. Pulling on the release lever unlocks both plungers.

Type "B" Kingpin Lock Mechanism (Fig. 10.4)

The Type "B" kingpin lock mechanism utilizes two spring-loaded lock halves. The final forward motion of the kingpin into the open lock halves forces the



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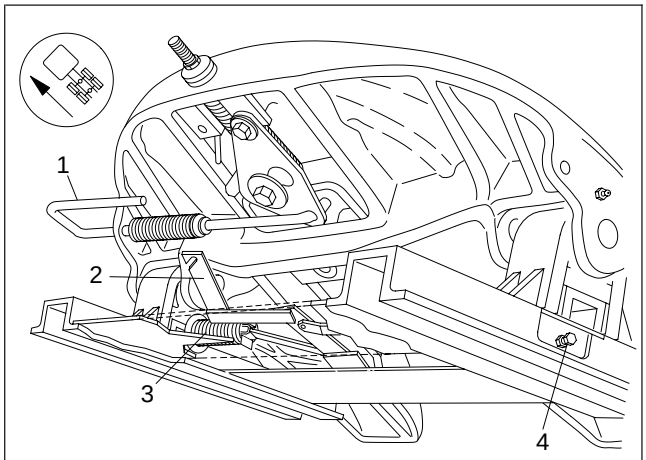
NOTE: Baseplate rails not shown.

1. Kingpin Lock Control Handle
2. Double-Ended Air Cylinder
3. Slide Plunger Release

Fig. 10.2, Air-Operated Release Slide Assembly



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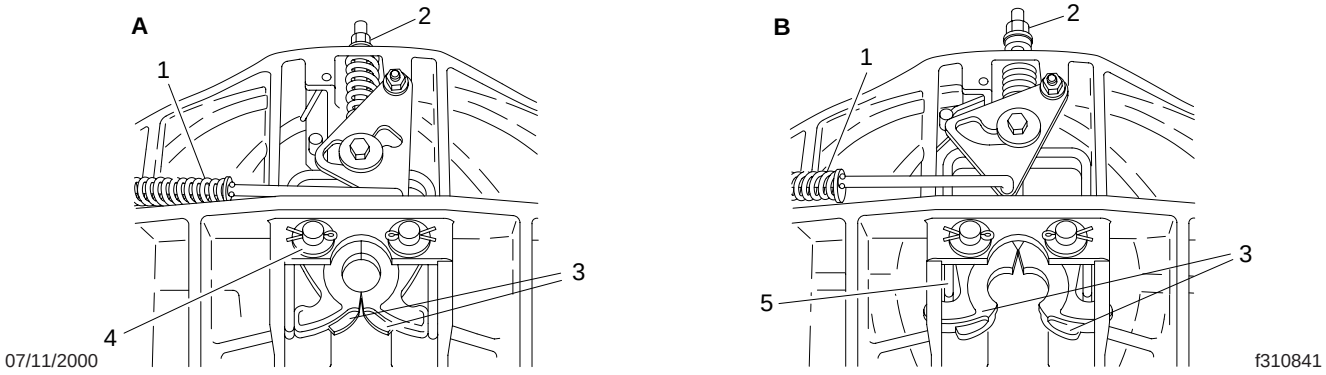
NOTE: Baseplate rails not shown.

1. Kingpin Lock Control Handle
2. Plunger Release Handle
3. Plunger Release Spring
4. Plunger

Fig. 10.3, Manual Release Slide

locks to close in a 360 degree grip around the shoulder and neck of the kingpin, positioning sliding yokes between the lock halves and tapered rib members of the fifth wheel understructure. The kingpin can be released only by manually operating the kingpin lock



A. Closed Position, Locked
1. Release Handle and Spring
2. Adjustment Nut
3. Lock Halves
4. Lock Pivot

B. Open Position, Unlocked
5. Sliding Yoke

Fig. 10.4, Type "B" Kingpin Lock Mechanism (bottom view)

control handle. The adjustment nut will compensate for wear on the lock or kingpin.

Lockguard

The Holland lockguard is a device that prevents a false lockup, and is used on all models. See **Fig. 10.5**. The Lockguard is a spring-tensioned, smooth-surfaced tongue that the kingpin passes over and depresses when entering the lock mechanism. The Lockguard will prevent the locks from engaging before the kingpin fully enters the locks. If the kingpin enters the fifth wheel incorrectly and does not depress the tongue, the locks are unable to close.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Mechanism

CAUTION

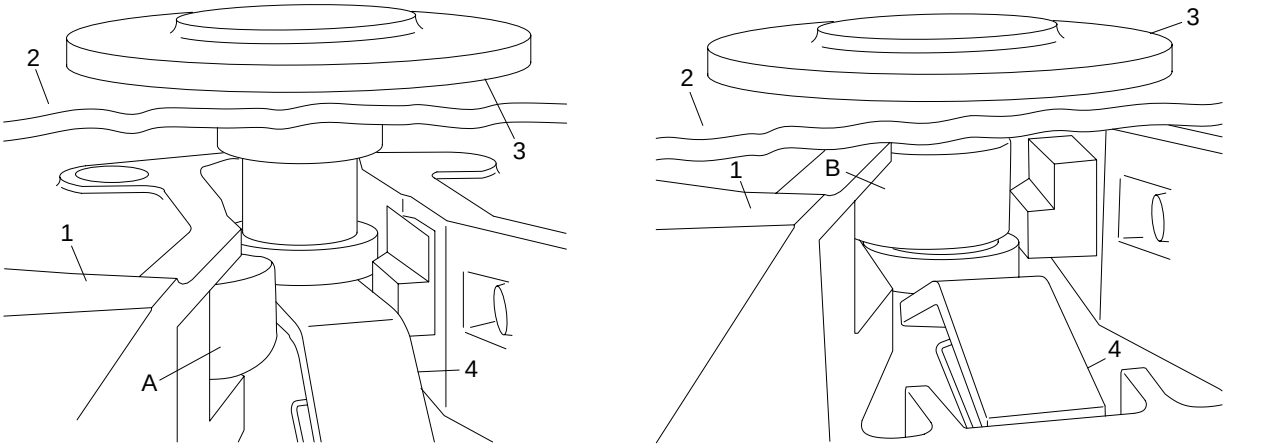
Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel or kingpin.

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

2. The kingpin lock mechanism must be fully open, and the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.
3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, to prevent a false lockup. See **Fig. 10.5**. Adjust the trailer landing gear to give enough alignment height so that the fifth wheel picks up the trailer on the fifth wheel ramps.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin correctly enters the throat of the locking mechanism. When the trailer is picked up by the fifth wheel, stop the tractor, then continue slow backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.



A. Locks open.
B. Locks closed.
C. Kingpin correctly entering the lock. Note how the depressed tongue allows lock halves to close completely around the neck and shoulder of the kingpin.
D. Kingpin incorrectly entering the lock. Note how the steel tongue prevents lock halves from closing, preventing false lockup.

1. Fifth Wheel Plate
2. Trailer
3. Kingpin
4. Lockguard

Fig. 10.5, Lockguard Mechanism (rear view)

⚠ WARNING

Adjust the locks correctly to a maximum clearance of 1/8 inch (3 mm). Incorrect adjustment of the lock could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

6. Make a visual check for proper kingpin lockup. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks. Check for correct maximum clearance between the lock halves. If more than 1/8-inch (3.2-mm) clearance exists between the lock halves, the lock must be adjusted. See **Group 31** of the *Century Class Trucks Workshop Manual* for adjustment procedures.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

7. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air lines.
8. Charge the air brake system with air. Make sure that the air connections do not leak.
9. Retract the trailer landing gear and secure the ratchet handle.
10. Remove the chocks from the trailer tires.
11. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

    Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

    The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety

Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

⚠ WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.
3. Chock the front and rear of the trailer tires to prevent the trailer from moving.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

4. Lower the trailer landing gear until the weight is removed from the fifth wheel.
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

⚠ CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel or kingpin.

6. Release the kingpin locking mechanism by pulling the kingpin lock control handle (**Fig. 10.1**) to the outward position.
7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Holland "Fifth Wheel Locking Operation," in this chapter.
2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the sliding member using one of the following methods:

   2.1 For air-operated models, set the cab-operated control switch (**Fig. 10.6**) to UNLOCK.

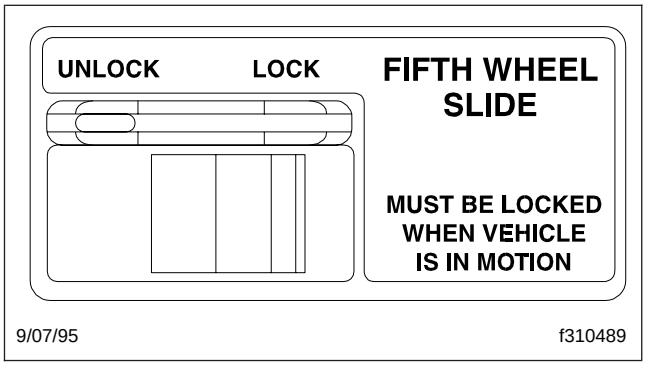
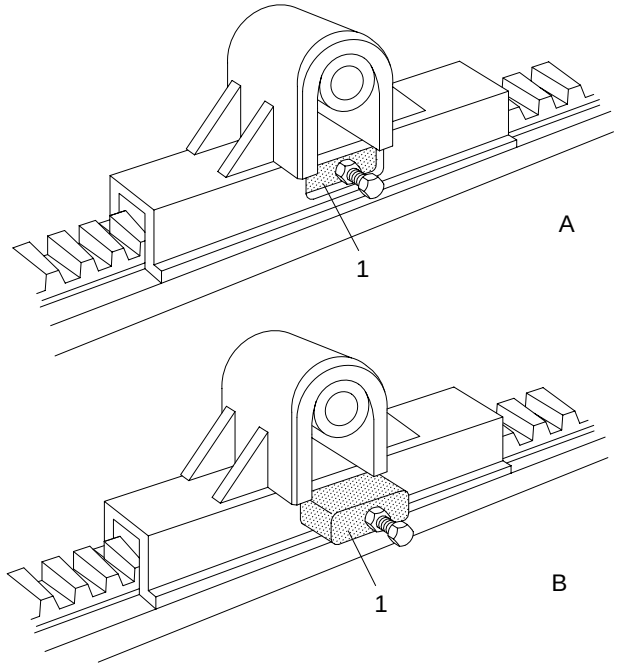


Fig. 10.6, Cab Control, Fifth Wheel Slide

   2.2 For manual release models, pull the release lever (**Fig. 10.3**) using a release hook, or other suitable tool. Make sure both slide plungers have released. See **Fig. 10.7**. If the plungers haven't released (haven't come out), lower the trailer landing gear to relieve pressure on the plungers.

3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.
5. Chock the front and rear of the trailer tires to prevent the trailer from moving.



A. Locked (engaged) B. Unlocked (released)
1. Plunger

Fig. 10.7, Plunger Positions

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

⚠ CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking plungers to enter the fully locked position.

8. Lock the sliding member into position using one of the following methods:

⚠ WARNING

Check to be sure that the slide plungers are in the locked position. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

8.1 For air-operated models, set the cab-operated control switch to LOCK. Visually check the slide plungers to make sure they are engaged in the fully locked position. See **Fig. 10.7**.

8.2 For manual release models, trip the release lever (**Fig. 10.3**) using a release hook or other suitable tool. Make sure that both plungers have locked (retracted into their pockets), and are fully engaged in the rack teeth. See **Fig. 10.7**. It may be necessary to move the tractor slightly while keeping the trailer brakes locked.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

   Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

   The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

⚠ WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication

⚠ WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

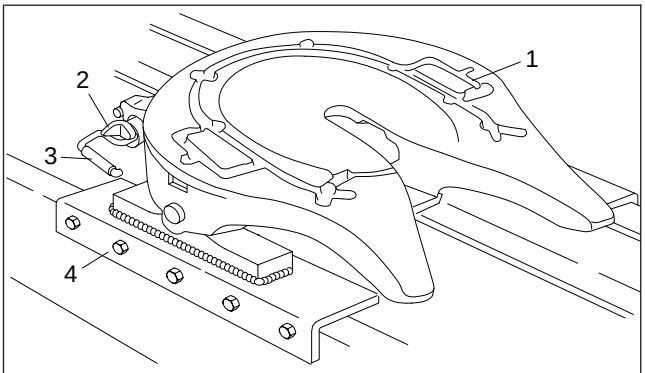
For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.

ASF Castloc® II and Simplex® Series Fifth Wheels

General Information

The ASF Castloc II and Simplex series fifth wheels are used for pulling trailers having the standard 2-inch diameter kingpin. When installed as a stationary fifth wheel (**Fig. 10.8**), they are bracket-mounted to the tractor frame in a position that best distributes the trailer load over the tractor axles. When used as a sliding fifth wheel (**Fig. 10.9**), they are mounted on the Taperloc® sliding mount (air-operated or manual release).

The fifth wheel lock mechanism for the trailer kingpin consists of a rotating jaw that grips the trailer kingpin and a spring-actuated lock. The jaw rotates on a jaw pin during coupling and uncoupling operations. Kingpin lockup occurs when the kingpin is forced into the jaw and the operating rod handle moves to the locked position. The kingpin is released either by activating a manual operating rod, or if equipped with Touchloc®, by a dash mounted release-knob, which activates an air cylinder underneath the top plate. The air cylinder activates the operating rod. The operating rod is located on the left side of the fifth wheel for Castloc II and Simplex II fifth wheels, and on the right side for the Simplex fifth wheel assembly.



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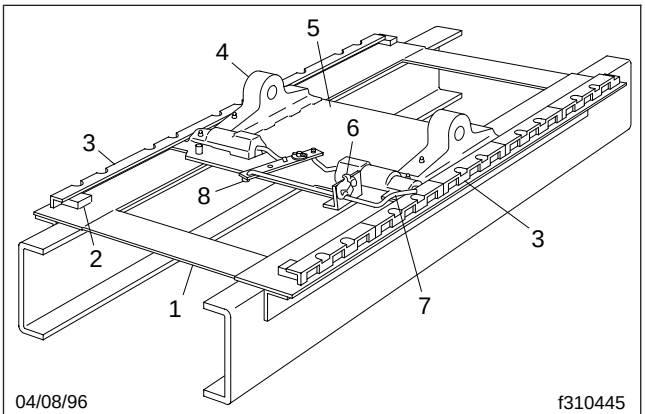
1. Lubricant Grooves
2. Safety Latch
3. Operating Rod
4. Mounting Bracket

Fig. 10.8, Simplex Stationary Fifth Wheel



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1. Baseplate
2. Bolted Stop
3. Baseplate Rail
4. Fifth Wheel Mount
5. Slider Saddle Plate
6. Safety Latch
7. Operating Rod
8. Operating Lever

Fig. 10.9, Taperloc Slide, Manually-Operated Release

On sliding fifth wheels, the top plate is mounted on a sliding saddle plate which slides along the baseplate attached to the tractor frame. The baseplate rails allow forward and rear movement of the slide assembly for optimum weight distribution over the tractor axles.

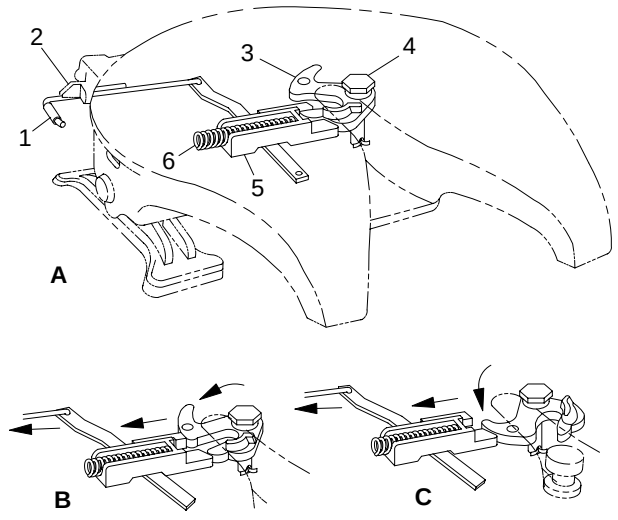
Tapered slots in the baseplate rails, aligned in 4-inch (102-mm) increments, provide for location of the fifth wheel along the baseplate. Retractable, spring-actuated lockpins are positioned through the slots to

hold the fifth wheel in the desired position. The lockpins are retracted either manually or by an air-operated cylinder controlled from the cab.

The manually-operated slide contains an operating rod (**Fig. 10.9**) which unlocks both sides of the plate at the same time.

The air-operated sliding saddle plate contains an air cylinder which moves the operating lever to unlock both sides of the plate at the same time. The air cylinder is activated by a two-position air-control valve in the tractor cab.

Fifth Wheel Lock Mechanism for Trailer Kingpin (Fig. 10.10)



A. Locked Position
B. Jaw movement compresses spring.
C. Fully open.

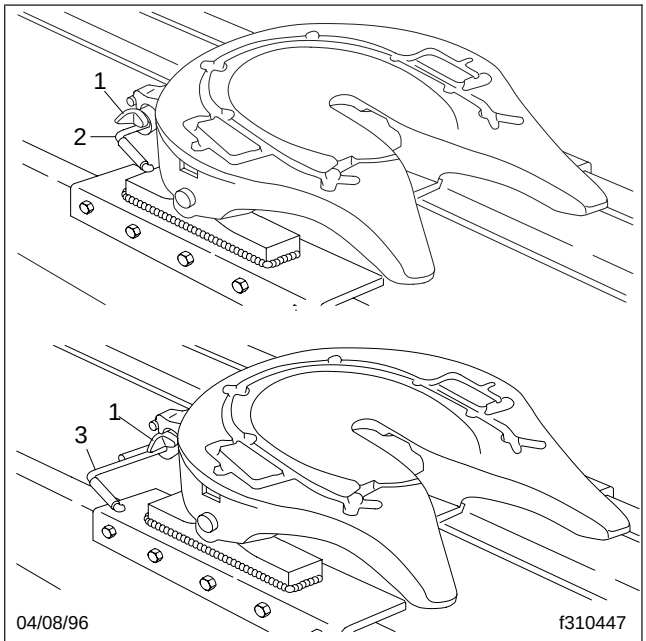
1. Operating Lever
2. Safety Latch
3. Jaw
4. Jaw Eccentric Pin
5. Lock
6. Spring

Fig. 10.10, ASF Castloc II and Simplex Series Kingpin Locking Mechanism Operation

The Castloc II and Simplex Series fifth wheel lock mechanism consists of a rotating jaw and a spring-actuated lock that grips the trailer kingpin. The jaw rotates on an eccentric pin during coupling and uncoupling operations. The spring-actuated lock holds the jaw in the locked position once kingpin lockup has occurred.

In the locked position, there is approximately 1/16-inch (1.6-mm) clearance between the jaw and kingpin. The jaw eccentric pin can be removed and rotated to compensate for wear and maintain an approximate 1/16-inch (1.6-mm) clearance during service.

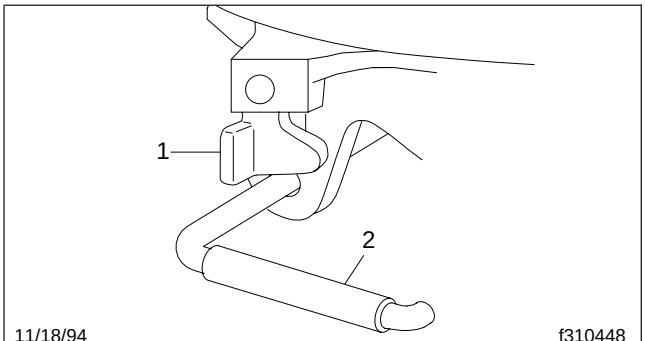
Placing the operating rod in the lockset position moves the lock away from the jaw. This action unlocks the jaw so that it can be rotated by movement of the kingpin. When the tractor is moved out from under the trailer, the kingpin will rotate the jaw until the jaw is in the unlocked position, allowing the kingpin to move out of the mechanism. With the jaw in the fully open position, the operating rod drops out of the lockset position, and the fifth wheel is ready for coupling. See **Fig. 10.11**.



1. Safety Latch
2. Operating Rod (locked)
3. Operating Rod (unlocked)

Fig. 10.11, Simplex Kingpin Locking Mechanism, Locking and Unlocking

During coupling, the kingpin contacts and rotates the jaw into the locked position. This action automatically moves the operating rod into the locked position. This securely locks the jaw around the kingpin. In the locked position the safety latch swings freely over the operating rod. See **Fig. 10.12**.



1. Safety Latch 2. Operating Rod

Fig. 10.12, Simplex Kingpin Locking Mechanism, Safety Latch (locked position)

Fifth Wheel Locking and Unlocking

Locking the Fifth Wheel Lock Mechanism

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

CAUTION

Before attempting to lock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide operating rod (Fig. 10.9) must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

2. The fifth wheel jaw must be fully open. Make sure that the operating rod is in the unlocked position. The fifth wheel must be completely lubricated with chassis or multi-purpose grease. For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

3. Make sure the fifth wheel top plate is tilted so the ramps are as low as possible. If equipped with an air suspension, make sure the air bags are completely inflated.
4. Position the tractor so that the center of the fifth wheel is in line with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism. See **Fig. 10.10**. Adjust the trailer landing gear so that the lower front trailer edge contacts the top surface of the tilted fifth wheel plate, approximately 8 inches (20 cm) before the fifth wheel center.
5. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.
6. Apply the tractor parking brakes.
7. Make a visual check (even if equipped with the Touchloc air-operated system) for positive kingpin lockup. The trailer bed plate must be flush on the fifth wheel plate surface. When positive lockup has occurred, the fifth wheel operating rod will have moved inward to the locked position, and the safety latch will swing freely over the operating rod. See **Fig. 10.12**.

NOTE: Only when the operating rod is fully retracted in the locked position will the safety latch be freely rotated down.

8. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

9. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
10. Charge the air brake system with air. Make sure that the air connections do not leak.

⚠ WARNING

Adjust the jaw pin if there is more than 1/8-inch (3-mm) clearance between the kingpin and the lock. Incorrect adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

11. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. A clearance of approximately 1/16 inch (1.6 mm) between the jaw and kingpin is allowable. When clearance between the jaw and kingpin exceeds 1/8 inch (3 mm), adjust the jaw to restore the 1/16-inch (1.6-mm) clearance between the jaw and kingpin. For instructions, see **Group 31** of the *Century Class Trucks Workshop Manual*.
12. Retract the trailer landing gear, and secure the ratchet handle.
13. Remove the chocks from the trailer tires.
14. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

    Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

    The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight ratings given on the FMVSS or CMVSS label.

⚠ WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.
4. Lower the trailer landing gear until the trailer rises about 1/2 inch (13 mm).
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

⚠ WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

6. *If equipped with a manual kingpin lock release:* Release the kingpin lock mechanism by raising the safety latch to the rear and pulling the lock operating rod out and up into the lockset position. See **Fig. 10.11**. The offset of the lock control upper rod should bottom against the plate casting above the hole. If the operating rod cannot be pulled to the lockset position, back the tractor slightly to release the kingpin force against the jaw.

   If equipped with an air-operated kingpin lock release: Pull the air-release knob on the dash. *From outside the cab,* visually check that the operating rod has bottomed out against the plate casting above the hole. See **Fig. 10.11**. If the operating rod isn't in the unlocked position, back the tractor slightly to release the kingpin force against the jaw.

IMPORTANT: If equipped with an air-operated lock release, you still must make a visual check

of the operating rod to make sure it is in the unlocked position

7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to "Fifth Wheel Locking Operation," in this chapter.
3. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:

   3.1 For air-operated models, set the cab-operated control switch (**Fig. 10.6**) to UNLOCK.

   3.2 For manually-operated models, raise the safety latch and pull the slide operating rod (**Fig. 10.9**) outward until the shoulder is outside of the operating rod support, then lower the operating rod as far as it will go.

4. Lower the trailer landing gear just enough to remove the weight from the tractor.
5. Pull the trailer air supply valve to cut off the air supply to the trailer.

⚠ CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

⚠ WARNING

Check to be sure that the lockpins are seated in the holes and that the operating rod is in the locked position with the safety latch securing the operating rod. Failure to achieve complete lockup may cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

NOTE: The fifth wheel may have to be moved slightly to enable the locking pins to enter the fully locked position.

8. Lock the sliding member into position using one of the following methods:

   For air-operated models: Set the cab-operated control switch to LOCK. Visually inspect the lockpins to make sure they have seated in the baseplate rail holes.

   For manually-operated models: Raise the operating rod so that it is free to move inward. Make sure that the lockpins have seated in the baseplate rail holes and the operating rod moves into the locked position. Also, the safety latch must drop downward so that it holds the operating rod in the locked position.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

   Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

   The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

⚠ WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication

⚠ WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

The fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer. For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.

Fontaine Fifth Wheels

General Information

The Fontaine sliding fifth wheel mount is designed to provide optimum axle loading for maximum tractor use with different lengths and types of trailers. The sliding fifth wheel mount is used with the Fontaine H5092 series, and 6000/7000 No-Slack II series fifth wheels, and is equipped with either an air-operated release slide (AWB or HAWB models), or a manual release slide (MWS or HMWS models).

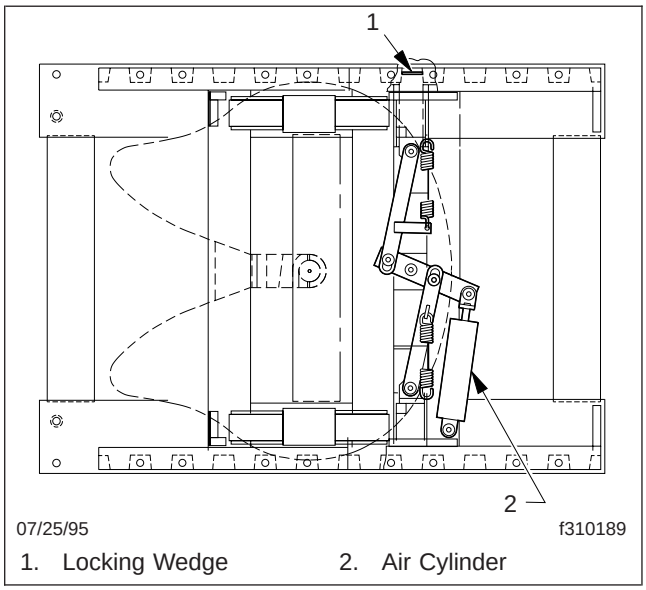
On Fontaine fifth wheels kingpin release is accomplished by activating a manual lock control handle located on either the right side or left side of the fifth wheel. Kingpin lockup occurs when the kingpin is forced into the jaws and the lock control handle moves to the locked position.

The fifth wheel top plate is mounted on a slide assembly, which is attached to slide rails that are mounted on the vehicle frame. The slide rails permit forward and rearward movement of the slide assembly, allowing for optimum weight distribution over the tractor axles.

Slots are evenly spaced along the slide rails, and retractable tapered wedges are positioned through the slots to hold the fifth wheel in the desired position. See **Fig. 10.13** or **Fig. 10.14**.

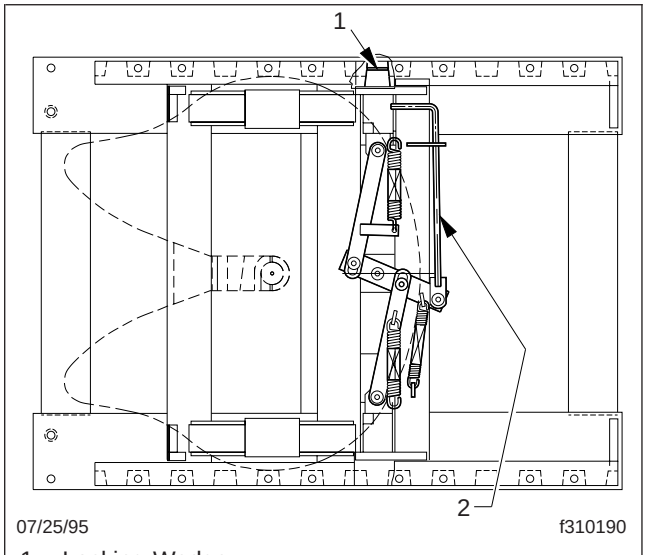
The slide portion of the sliding model may be attached to either an air-operated release slide, or a manual release slide.

The air-operated release slide contains an air cylinder that locks and unlocks the fifth wheel slide. See **Fig. 10.13**. The air cylinder is activated by a two-position air-control valve in the tractor cab.



1. Locking Wedge
2. Air Cylinder

Fig. 10.13, Air-Operated Sliding Fifth Wheel Mount, AWB Model



1. Locking Wedge
2. Slide Release Pull Handle

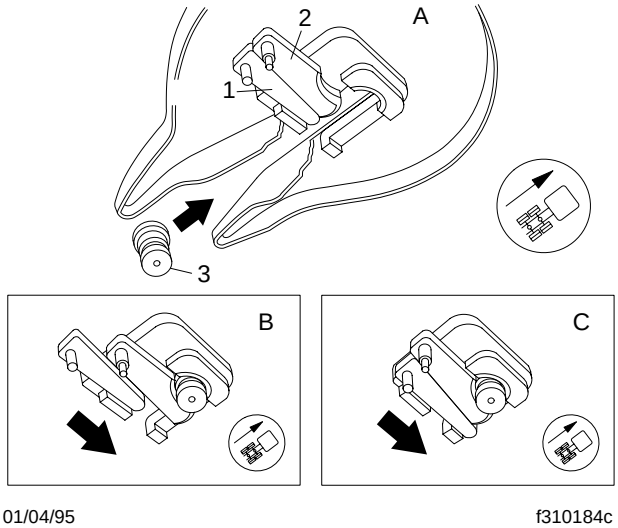
Fig. 10.14, Manual Release Sliding Fifth Wheel Mount, MWS Model

The manual release slide contains a slide release pull handle, located on the left side of the fifth wheel,

which locks or unlocks the fifth wheel slide. See **Fig. 10.14**.

Fifth Wheel Lock Mechanism for Trailer Kingpin

The Fontaine fifth wheel lock mechanism (**Fig. 10.15**) for the trailer kingpin consists of a spring-loaded jaw and a sliding wedge.



A. Unlocked Position
B. Locking
C. Locked
1. Wedge
2. Jaw
3. Trailer Kingpin

Fig. 10.15, Fontaine Kingpin Lock Mechanism

The jaw and wedge each have a pin permanently attached. The pin on the jaw and the pin on the wedge fit into elongated notches in the lock control handle. The notches in the handle control the limit of movement for both the jaw and wedge. The notches are arranged so that the wedge is actuated first during release of the kingpin.

During lockup, the jaw is moved first with the spring-loaded wedge being allowed to slip in place against the jaw. A timing bracket ensures that the wedge and jaw are moved at the proper time.

Placing the lock control handle in the unlocked position moves the wedge away from the jaw. This action unlocks the jaw so that it can be moved by the trailer kingpin. When the tractor is moved out from under the trailer, the kingpin moves the jaw until the kingpin is out of the mechanism. With the jaw in the unlocked position, the lock control handle will remain in the unlocked position until manually moved by the operator.

During coupling (**Fig. 10.15**), the motion of the kingpin entering the jaw will actuate the jaw and wedge. The jaw will move behind the kingpin, followed by the wedge. The purpose of the wedge is to reinforce the jaw and take up slack around the pin. Any wear on the jaw is immediately taken up by the wedge so there is no slack in the connection.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Lock Mechanism

CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release pull handle, if so equipped, and the slide locking wedges must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

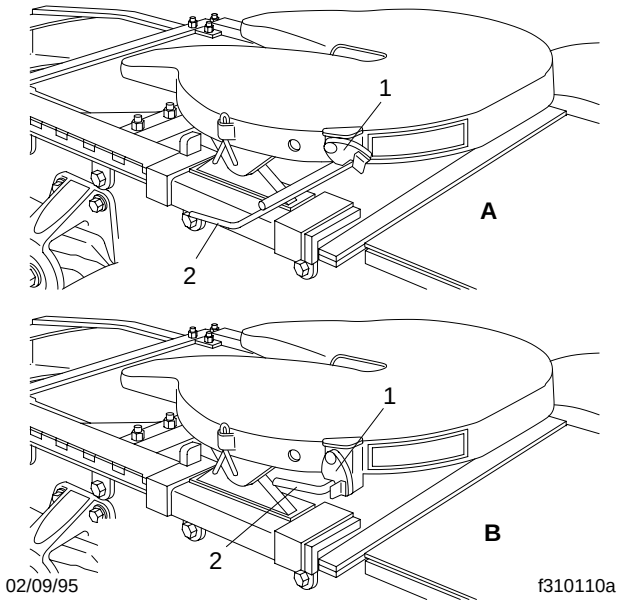
WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

2. The kingpin lock mechanism must be fully open, the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.
3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism (**Fig. 10.15**). Adjust the trailer landing gear to give enough alignment height for positive kingpin lockup.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the

trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.

5. Apply the tractor parking brakes.
6. Make a visual and physical check for positive kingpin lockup. When lockup has occurred, the fifth wheel control handle will have moved to the locked position. Make sure that the safety latch is down over the lock control handle. See **Fig. 10.16**. This will hold the control handle in the locked position.



NOTE: Make sure the safety latch is down when the control handle is locked.

A. Unlocked
B. Locked
1. Safety Latch
2. Lock Control Handle

Fig. 10.16, Fontaine Fifth Wheel, Locking and Unlocking

7. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

8. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
9. Charge the air brake system with air. Make sure that the air connections do not leak.

⚠ WARNING

Eliminate slack between the trailer and the tractor. Incorrect fifth wheel adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

10. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. There should be no slack between the tractor and the trailer. If slack is present, uncouple the trailer.

    For adjustment instructions, refer to the applicable manufacturer's service information.

11. Retract the trailer landing gear, and secure the ratchet handle. Remove the chocks from the trailer tires.
12. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

    Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

    The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

⚠ WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.
4. Lower the trailer landing gear until the weight is removed from the fifth wheel.
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

⚠ CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release pull handle, if so equipped, and the slide locking wedges must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

6. Release the kingpin locking mechanism by lifting the safety latch and pulling the lock control handle to the unlocked position. See **Fig. 10.16**.
7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Fontaine "Fifth Wheel Locking Operation," in this chapter.
2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:

2.1 For air-operated release models, set the cab-operated control switch (**Fig. 10.6**) to UNLOCK.

2.2 For manual release models, lift the slide release pull handle to disengage it from the guide plate. Then, pull out the handle (**Fig. 10.17**) until it is in the unlocked position and can be positioned against the guide plate to hold it out. The slide release pull handle will stay in the unlocked position until it is manually disengaged from the guide plate.

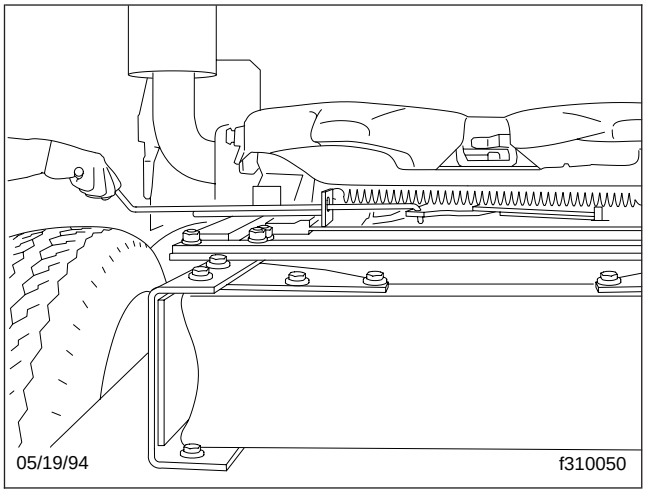


Fig. 10.17, Fontaine Sliding Fifth Wheel Manual Release

3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

5. Chock the front and rear of the trailer tires to prevent the trailer from moving.

⚠ CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking wedges to enter the fully locked position.

8. Lock the sliding member in position using one of the following methods:

⚠ WARNING

Check to be sure that the lockpins are seated in the holes. Failure to achieve complete lockup may cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

8.1 For air-operated release models, set the cab-operated slide control switch to LOCK. Visually inspect the locking wedges to make sure that they are fully inserted in the slide rail slots.

8.2 For manual release models, disengage the slide release pull handle from the guide plate. The slide release pull handle is spring-loaded in the locked position and will seek the locked position when disengaged from the guide plate. The fifth wheel may have to be moved slightly to enable the locking wedges to fully enter the locked position. When the slide release pull handle returns to the fully locked position, visually and physically check the locking wedges to make sure they are fully inserted into the slots in the slide rails. Make sure the slide release pull handle is locked in position against the guide plate.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

   Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

   The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

⚠ WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication

⚠ WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

For lubrication instructions, see **Group 31** of the *Century Class Trucks Maintenance Manual*.

Premier Trailer Couplings

General Information

IMPORTANT: Before operating the Premier coupling, refer to the Premier web site at **www.premier-mfg.com** for complete safety, operation, and maintenance instructions.

Trailer couplings, used only on trucks, are attached to the rear closing crossmember.

The Premier 260 and 460 trailer couplings (**Fig. 10.18**) have a rigid pintle hook, and are air-adjusted. An air chamber, mounted forward of the coupling, operates a push rod, which pushes against a shoe inside the coupling. The shoe maintains constant pressure on the eye of the trailer drawbar when it's over the pintle hook. This takes up any slack in the trailer connection, providing smoother towing and less wear on the pintle hook. The air pressure is activated when the trailer brakes are released.

The Premier 690 trailer coupling (**Fig. 10.19**) has a moveable pintle hook, and is nonair adjusted. It is used for heavy-duty applications.

Operation

⚠ WARNING

If at any time the 690 coupling is bound up (jackknifed), the 294 bolt MUST be replaced immediately! Do not use the coupling until the bolt has been replaced. In addition, carefully inspect the 690 coupling, drawbar, drawbar eye, front end assembly, and tail board for damage. Failure to do so may result in trailer separation from the truck while in use, resulting in serious personal injury or property damage.

Trailer Hookup

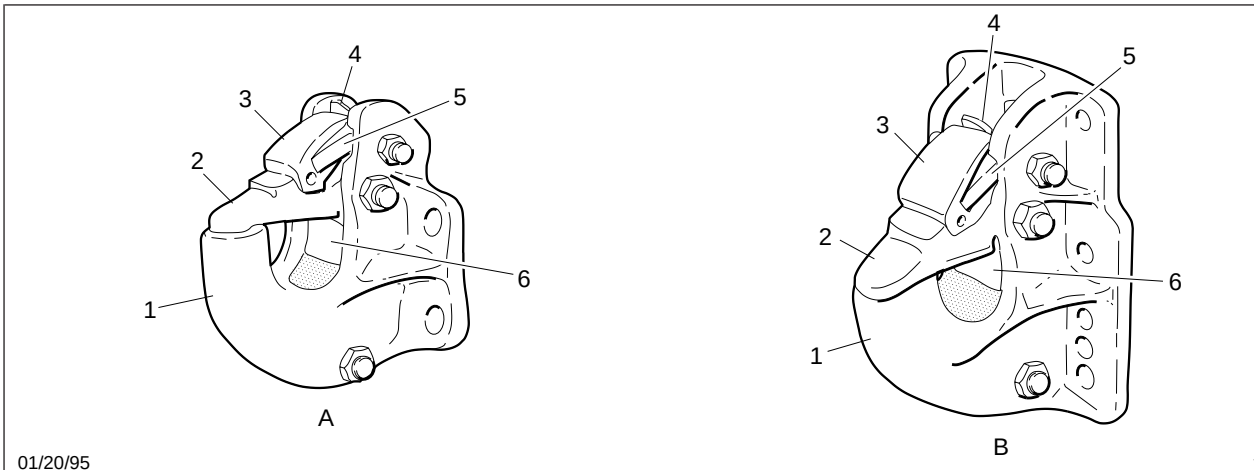
1. Chock the front and rear tires of the trailer.
2. Open the coupling.

   Models 260 and 460 (**Fig. 10.18**): Pull up on the pawl lock; then, while squeezing the pawl wedges together, lift up the pawl assembly. Lift up the latch and push it up against the pawl assembly, locking the latch in place.

   Model 690 (**Fig. 10.19**): Remove the linch pin from the handle, then push in on the handle and turn it toward you. Open the pintle hook by pulling it down and toward you. Release the handle, locking the pintle hook open.
3. *Models 260 and 460:* Back up the vehicle until the drawbar eye is over the pintle hook, then lower the trailer.

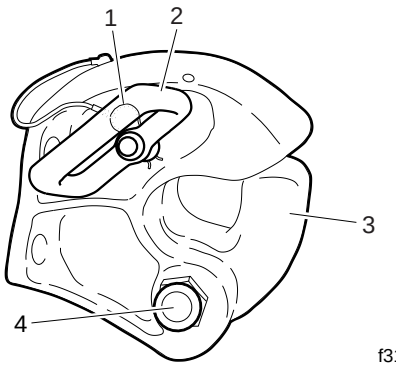
   Model 690: Back up the vehicle until the drawbar eye enters the open jaw, contacts the back of the pintle hook, and closes the coupling.
4. Close the coupling.

   Models 260 and 460: Push in on the pawl wedges and lift the pawl assembly. The latch will drop into the closed position. Lock the latch by lowering the pawl assembly.



A. Model 260
B. Model 460
1. Pintle Hook
2. Latch
3. Pawl Assembly
4. Pawl Lock
5. Pawl Wedge
6. Shoe

Fig. 10.18, Premier 260 and 460 Trailer Couplings



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1. Linch Pin
2. Handle
3. Pintle Hook
4. 294 Bolt

Fig. 10.19, Premier 690 Trailer Coupling

Model 690: The pintle hook will automatically close and lock from the pressure of the drawbar eye against it. Install the linch pin.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

5. Hook up the trailer's electrical and air lines.
6. Remove the chocks from the trailer's tires.

Trailer Release

1. Apply the truck and trailer parking brakes.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

2. Chock the front and rear tires of the trailer.
3. Disconnect the trailer air and electrical lines. Plug the air lines to keep out dirt.
4. Take the weight of the trailer drawbar eye off the pintle hook.
5. Open the coupling.

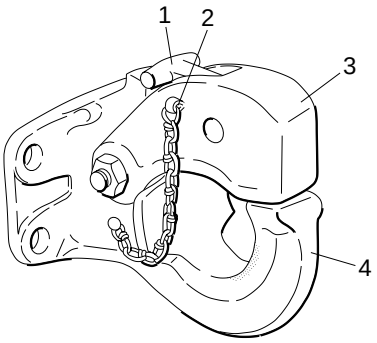
   Models 260 and 460: Pull up on the pawl lock; then, while squeezing the pawl wedges together, lift up the pawl assembly. Lift up the latch, and push it up against the pawl, locking the latch in place.

   Model 690: Remove the linch pin from the handle, then push in on the handle and turn it toward you. Open the pintle hook by pulling it down and toward you. Release the handle, locking the pintle hook open.
6. Slowly drive the vehicle away from the trailer.

Holland Trailer Coupling

General Information

The Holland PH–T–60–AL trailer coupling is designed for use with trailers having a maximum gross weight of 10,000 pounds. It is a rigid type pintle hook, used only on truck applications, and is fastened to the rear closing crossmember of the vehicle. See **Fig. 10.20**. It is a non-air adjusted coupling.



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1. Lock
2. Cotter Pin
3. Latch
4. Pintle Hook

Fig. 10.20, Holland PH-T-60-AL Trailer Coupling

Operation

Trailer Hookup

1. Chock the front and rear tires of the trailer.
2. Remove the cotter pin. Then lift the lock and raise the latch.

3. Back up the vehicle until the drawbar eye is over the pintle hook.
4. Lower the trailer until the drawbar eye rests on the pintle hook.
5. Close the latch, then insert the cotter pin.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

6. Hook up the trailer's electrical and air lines.
7. Remove the chocks from the trailer's tires.

Trailer Release

1. Apply the truck and trailer parking brakes.

⚠ WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

2. Chock the front and rear tires of the trailer.
3. Disconnect the trailer air and electrical lines. Plug the air lines to keep out dirt.
4. Take the weight of the trailer drawbar off the pintle hook.
5. Open the latch by first removing the cotter pin; then lift up the lock and raise the latch.
6. Slowly drive the vehicle away from the trailer.

11

Pretrip Inspection and Daily Maintenance

Pretrip and Post-Trip Inspection Checklists 11.1
Pretrip and Post-Trip Inspection and Maintenance Procedures 11.3

Pretrip and Post-Trip Inspection Checklists

Regulations in both Canada and the United States clearly indicate that it is the driver's responsibility to perform an inspection and ensure the complete roadworthiness of a vehicle before placing it into service for the day. Commercial vehicles may be subject to inspection by authorized inspectors, and an unsafe vehicle can be put "out of service" until the driver or owner repairs it.

Use the inspection checklists to ensure that vehicle components are in good working condition before each trip. A driver that is familiar with the vehicle, and drives it regularly, can perform the daily inspections, then add the weekly and monthly post-trip inspections as scheduled. If the driver does not operate the vehicle on a consistant basis, all three of the inspection procedures should be performed before the trip.

NOTE: Procedure reference numbers in the the checklists reference the corresponding detailed instructions found under the pretrip and post-trip maintenance procedures.

Pre- and post-trip inspections cannot be done quickly. However, careful inspections save time by eliminating stops later to adjust items overlooked or forgotten.

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *Century Class Trucks Workshop Manual* for procedures and specifications, and see the *Century Class Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

IMPORTANT: The pre- and post-trip checklists, and inspections and maintenance procedures detailed in this chapter, are **not all-inclusive**. Also refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions.

See **Table 11.1** for a list of procedures that should be perfomed daily, before the first trip.

See **Table 11.2** for a list of procedures that should be performed weekly, post-trip.

See **Table 11.3** for a list of procedures that should be performed monthly, post-trip.

IMPORTANT: Before performing any checks, apply the parking brake and chock the tires.

Procedure Performed (check off)	Daily Pretrip Inspections/Checks	Procedure Reference
_____	Drain manually drained air reservoirs (that are not equipped with automatic drain valves)	D1
Check _____	windshield washer reservoir fluid	D2
Inspect _____	wheel seal and hub cap (for leakage)	—
Check _____	surge tank coolant level	D3
Inspect _____	radiator and charge air cooler	D4
Check _____	engine for fuel, oil, or coolant leaks	—
Inspect _____	engine and chassis wiring	D5
Inspect _____	air intake system	D6
Check _____	intake-air restriction indicator mounted on air intake	D6
Check _____	engine oil level	D7
Check _____	power steering fluid level	—
Inspect _____	fuel tank(s), fuel lines, and connections	D8
Check _____	fuel level	D9
Check _____	fuel/water separator	D10
Inspect _____	front and rear suspension components	D11
Inspect _____	headlights, mirrors, and window glass, and windshield wipers	D12
Check _____	doors (open without difficulty and close securely)	—
_____	Adjust driver's seat, then align rearview and downview mirrors	—
Check _____	dash-mounted intake-air restriction indicator	D6
Check _____	oil- and air-pressure warning systems	D13
Check _____	ICU fault codes	D14
Check _____	horn, windshield wipers, and windshield washer	D15
Check _____	heater, defroster, and optional mirror heat controls	D16
Check _____	backup alarm	—
Check _____	panel lights and interior lights	D17
Check _____	exterior lights and reflectors	D18
Check _____	tire pressure	D19
Inspect _____	tire condition	D20
Inspect _____	rims and wheels	D21
Check _____	automatic transmission fluid level	—
Inspect _____	air brake chambers and pushrods	D22
Inspect _____	air brake lines	D23
Inspect _____	slack adjusters	D24
Check _____	air brake system operation	D25
Inspect _____	frame rails (missing bolts), crossmembers (bent or loose)	—
Check _____	mud flaps (aren't damaged, at least 10 inches above the ground, and brackets are secure)	—
Check _____	exhaust system (mounted securely, connected tightly, no signs of leaks such as soot trails)	—
_____	Remove chocks and test service brakes	D26
Inspector_____ Date _____		

Table 11.1, Daily Pretrip Inspection and Maintenance Checklist

Procedure Performed (check off)	Weekly Post-Trip Inspections/Checks	Procedure Reference
_____	Manually drain air reservoirs that are equipped with automatic drain valves	—
Inspect _____	batteries and battery cables	W1
Check _____	wheel bearing lubricant level	W2
Inspect _____	steering components	W3
Check _____	serpentine drive belt condition	W4
Check _____	V-belt tension	W5
Inspect _____	seat belts and tether belts	W6
Inspector_____ Date _____		

Table 11.2, Weekly Post-Trip Inspection and Maintenance Checklist

Procedure Performed (check off)	Monthly Post-Trip Inspections/Checks	Procedure Reference
_____	Clean the battery terminals	M1
Inspect _____	radiator hoses and heater hoses	M2
Check _____	fluid level in the hydraulic clutch reservoir (if applicable, and if necessary, fill with DOT 4 brake fluid)	—
Check _____	steering wheel play	M3
Check _____	outer surfaces of the hood and body (for visible surface breaks and damage)	—
Check _____	hood tilt damper (attached at both ends)	—
Inspect _____	brake lining wear	M4
Inspect _____	driveshaft	—
Inspector_____ Date _____		

Table 11.3, Monthly Post-Trip Inspection and Maintenance Checklist

Pretrip and Post-Trip Inspection and Maintenance Procedures

Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *Century Class Trucks Workshop Manual* for procedures and specifications, and see the *Century Class Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

Daily Pretrip Inspection and Maintenance Procedures

1. *Drain manually drained air reservoirs.*

   Water and oil normally enter the air reservoir in the form of vapor because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows:

   1.1 Open the wet tank valve. The drain cock or pull chain drain is located on the forward end of the supply air reservoir, which is connected directly to the air compressor. Block the valve open.

⚠ WARNING

When draining the air reservoir, do not look into the air jets or direct them toward anyone. Dirt or sludge particles may be in the airstream and could cause injury.

   1.2 Exhaust the remaining air and moisture from the system by opening the drain cocks on the bottoms of the remaining air reservoirs. Block the valves open.

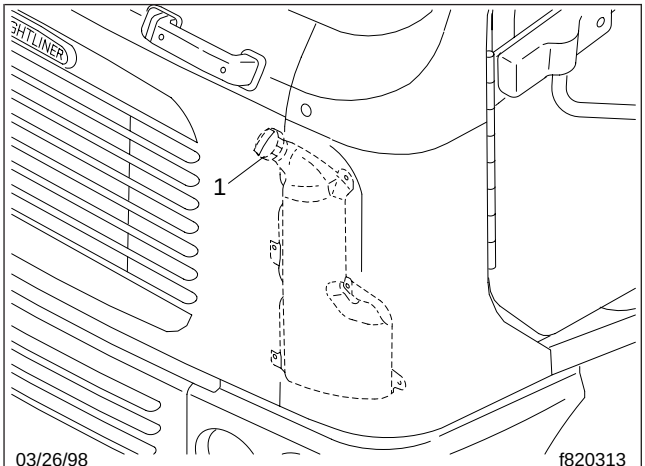
1.3 Water and oil emulsion often form pockets that will not drain while compressed air is in the reservoirs. Because of these pockets, leave the valves blocked open during the first part of the pretrip inspection.

1.4 If the drained water is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.

⚠ CAUTION

Step back from the front access panel when opening it. The access panel can open quickly and could hit a person, possibly resulting in personal injury.

2. Check that the windshield washer reservoir is filled. Add washer fluid as needed. See **Fig. 11.1**. The windshield washer reservoir is located on the left-hand side of the frontwall, behind the access panel.



1. Washer Reservoir

Fig. 11.1, Windshield Washer Reservoir

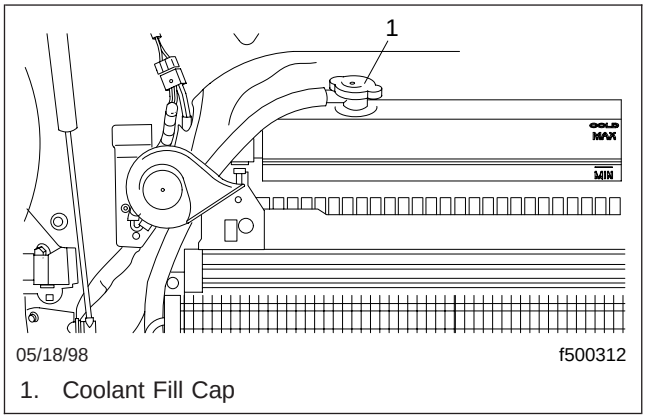
⚠ WARNING

Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

3. *Check the coolant level.*

   If the coolant is low, fill the surge tank to the MAX line, with a 50/50 mixture of water and the type of antifreeze currently installed in your vehicle.

   See **Fig. 11.2**.



1. Coolant Fill Cap

Fig. 11.2, Coolant Level Checking

⚠ CAUTION

Coolant must be filled to the full line of the surge tank. Low coolant could result in engine overheating, which could cause engine damage.

4. *Inspect the radiator and charge air cooler.*

   4.1 Inspect the radiator and charge air cooler for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.

   4.2 Inspect the radiator and charge air cooler for damage and accumulated debris. Straighten bent or damaged fins to permit airflow across all areas of the cores.

   NOTE: When traveling through areas of high insect concentration, it may be necessary to clean the exterior of the radiator or the charge air cooler core as often as every 200 miles (320 km).

   4.3 On vehicles equipped with air conditioning, also inspect and clean the condenser. If clogged, the condenser can restrict airflow through the radiator.

4.4 Check the radiator for leaks. If leaks are found, have the radiator repaired or replaced. See **Group 20** of the *Century Class Trucks Workshop Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.

5. *Inspect the engine and chassis wiring.*

   Check for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.

6. *Inspect the air intake system for leaks or damage.*

CAUTION

Failure to maintain a sealed air intake system could allow the entry of dirt and contaminants into the engine. This could adversely affect engine performance and result in engine damage.

6.1 Check the intake-air restriction indicator.

6.2 Replace the primary filter element in the air cleaner if the yellow signal stays locked at 25 inH_2O for Caterpillar engines or 20 inH_2O for Mercedes-Benz engines. See **Group 09** of the *Century Class Trucks Workshop Manual* for filter element replacement instructions, or take the vehicle to an authorized Freightliner dealer.

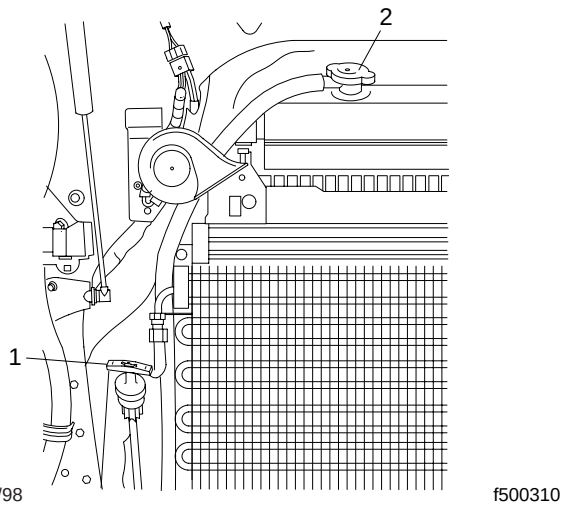
NOTE: After replacing the filter element, reset the restriction indicator by pressing the rubber reset button.

6.3 Inspect the secondary or safety filter element in the air cleaner when replacing the primary element, and replace it when clogged or dirty. This element should be replaced with every third primary element replacement.

6.4 Check the engine air intake piping from the air cleaner to the engine intake. Inspect the piping for loose connections, cracks, torn or collapsed hoses, punctures, and other damage. Tighten loose connections, and have damaged components replaced. Make sure the piping system is airtight so that all intake air passes through the air cleaner.

7. *Check the engine oil level.*

   If the oil level is at or below the minimum fill (or "add") mark on the dipstick, add enough oil to maintain the level between the minimum fill (or "add") and the maximum fill (or "full") marks on the dipstick. See **Fig. 11.3**. Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil. Use the proper SAE viscosity rating for the temperature and time of year.



1. Dipstick 2. Coolant Fill Cap

Fig. 11.3, Oil Level Checking

CAUTION

Operating the engine with the oil level below the minimum fill (or "add") mark or above the maximum fill (or "full") mark could result in engine damage.

8. *Inspect the fuel tanks, fuel lines, and connections for leaks.*

   8.1 Check that the fuel tanks are secured to their mounting brackets and that the mounting brackets are secured to the frame.

   8.2 Replace leaking fuel tanks.

   8.3 If lines or connections are leaking, have them repaired or replaced.

For repair and/or replacement procedures, see **Group 47** of the *Century Class Trucks Workshop Manual*, or take the vehicle in to an authorized Freightliner dealer.

8.4 If equipped with fuel tank shutoff valves, be sure the valves are fully open.

⚠ WARNING

Never operate the engine with the fuel tank shutoff valves partly closed. This could damage the fuel pump, causing sudden loss of engine power, possibly resulting in serious personal injury due to reduced vehicle control.

9. *Check the fuel level in the fuel tank(s).*

To keep condensation to a minimum, fuel tanks should be filled at the end of each day. Federal regulations prohibit filling a fuel tank to more than 95 percent of its liquid capacity.

⚠ WARNING

Never fill fuel tanks to more than 95 percent of their liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, possibly resulting in serious personal injury or death. Do not fill the fuel tanks in the presence of sparks, open flames, or intense heat. These could ignite the fuel, possibly causing severe burns.

9.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter and reduce the chances of dirt getting into the engine.

9.2 Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.

9.3 If needed, prime the fuel system. For priming procedures, see the applicable engine manufacturer's manual.

10. *If equipped with a fuel/water separator, check for water.*

Drain any water found. Check the fuel/water separator for leaks and contaminants.

For Racor models, see **Fig. 11.4**. Check the water level in the sight bowl. To drain the water, loosen the valve at the bottom of the bowl two full turns, and allow the water to run out. Close and tighten the valve finger-tight. Check the filter element and replace if clogged.

For ConMet models, see **Fig. 11.5**. Place a suitable container under the fuel/water separator. Check the water level in the sight bowl, if so equipped. To drain the water, loosen the valve at the bottom and allow the water to run out. Close and tighten the valve finger-tight.

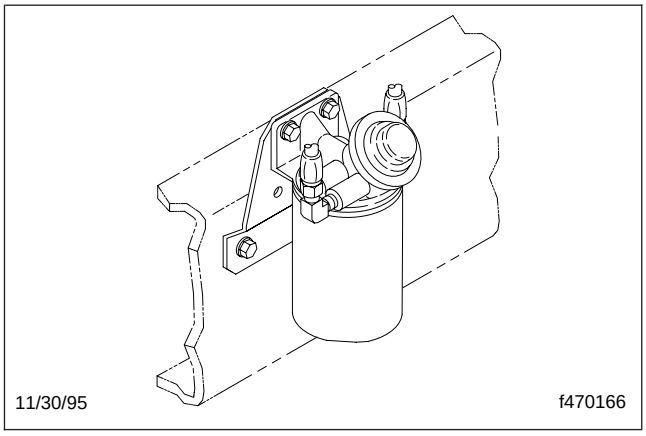


Fig. 11.4, Racor Fuel/Water Separator

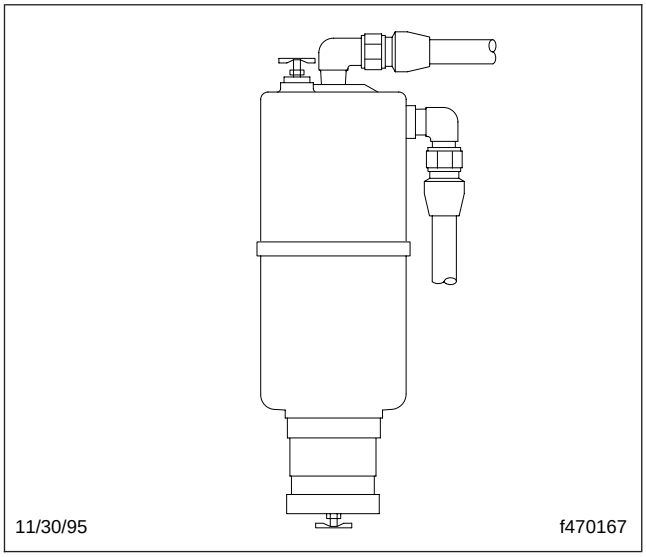


Fig. 11.5, ConMet Fuel/Water Separator

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.

11. *Inspect the front and rear suspension components, including springs, spring hangers, shocks, and suspension brackets.*

    11.1 Check for broken spring leaves, loose U-bolts, cracks in the suspension brackets, and loose fasteners in the spring hangers and shackles.

    11.2 Inspect the shock absorbers for loose fasteners and leaks.

    11.3 Tighten all loose fasteners and have any component(s) replaced that are worn, cracked, or otherwise damaged.

    11.4 On vehicles with air suspensions, check for leaks. Check air suspension components for cuts and bulges.

12. *Clean the windshield, side, and rear windows, then check the condition of the windshield wiper arms and blades.*

    12.1 Replace the wiper arms if the wiper blades are not tensioned against the windshield.

    12.2 Replace damaged or deteriorated wiper blades.

⚠ WARNING

When cleaning windshields and windows, always stand on the ground or on a secure ladder or platform. Use a long-handled window cleaner. Do not use the cab steps, tires, fenders, fuel tanks, engine, or under-hood components to access the windshield or windows. Doing so could cause a fall and result in an injury.

13. *Check the oil- and air-pressure warning systems.*

    13.1 Check if the warning systems come on when the ignition is turned on, and if not, have the systems repaired.

    13.2 Start the engine, then check that the oil- and air-pressure warning systems are operating. The buzzer should stop sounding when the preset minimum is reached. If the air pressure in both systems is above the preset minimum when the engine is started, test the low air pressure warning system by lowering the pressure to below this range, or until the warning system comes on.

    The air pressure in both the primary and secondary air reservoir systems must be above 65 psi (448 kPa) on most vehicles. For vehicles with an optional Bendix dryer reservoir module (DRM), the cut-out pressure is 130 psi (896 kPa).

14. *Check the instrumentation control unit (ICU) for fault codes.*

    During the ignition sequence, if an active fault is detected in any device that is connected to the ECU, the message display screen will show the active fault codes, one after the other, until the parking brake is released or the ignition switch is turned off. See **Chapter 2** for detailed operating instructions for the ICU.

15. *Make sure that the horn, windshield wipers, and windshield washers are operating properly. These devices must be in good working order for safe vehicle operation.*

    15.1 Make sure that the horn works. If a horn is not working, have it repaired before trip departure.

    15.2 Check the wiper and washer control on the multifunction turn signal switch. If the wipers and/or washers are not working, have them repaired before trip departure.

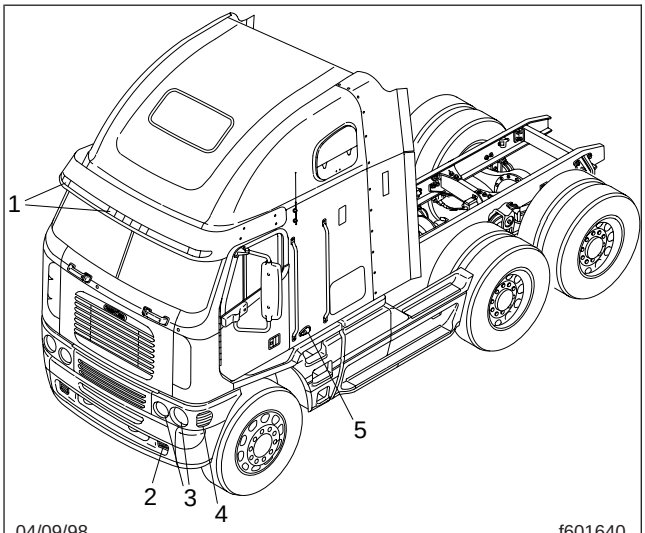
16. *During cold weather, make sure the heater, defroster, and optional mirror heat controls are operating properly. If so equipped, turn on the mirror heat switch and make sure the system is working.*

17. *Check the operation of all the panel lights and interior lights.*

    Turn on the headlights, dash lights, and four-way flashers and leave them on. If any of the gauge bulbs, the dome light bulbs, or the right- and left-turn indicator bulbs are not working, replace them.

18. *Make sure all the exterior lights are working properly.*

    Check that all the lights and reflectors are clean. See **Fig. 11.6**.



1. Identification Lights
2. Road Light
3. Headlight and Daytime Running Light
4. Turn Signal and Side-Marker Light
5. Marker Light

Fig. 11.6, Exterior Lights

18.1 Check that the brake lights, taillights, headlights, parking lights, turn signals, marker lights, identification lights, road lights (if so equipped), and front clearance lights are working properly and are clean.

18.2 Test the high and low beams of the headlights.

18.3 Replace light bulbs or sealed beam units that are not working.

18.4 Be sure all reflectors and lenses are in good condition and are clean. Replace any broken reflectors or lenses.

19. *Check tire inflation pressures using an accurate tire pressure gauge.*

    Tires should be checked when cool. For inflation pressures and maximum loads (per tire) see the tire manufacturer's guidelines.

    A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage. The tire should be inspected and, if necessary, repaired or replaced.

19.1 Be sure valve stem caps are on every tire and that they are screwed on finger-tight.

19.2 Inflate the tires to the applicable pressures if needed.

19.3 If a tire has been run flat or underinflated, check the wheel for proper lockring and side-ring seating, and possible wheel, rim, or tire damage before adding air.

Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-maintained inline moisture traps and service them regularly.

⚠ WARNING

Do not operate the vehicle with underinflated or overinflated tires. Incorrect inflation can stress the tires and make the tires and rims more susceptible to damage, possibly leading to rim or tire failure and loss of vehicle control, resulting in serious personal injury or death.

IMPORTANT: The load and cold inflation pressure must not exceed the rim or wheel manufacturer's recommendations, even though the tire may be approved for a higher load inflation. Some rims and wheels are stamped with a maximum load and maximum cold inflation rating. If they are not stamped, consult the rim or wheel manufacturer for the correct tire inflation pressure for the vehicle load. If the load exceeds the maximum rim or wheel capacity, the load must be adjusted or reduced.

20. *Inspect each tire for wear, bulges, cracks, cuts, penetrations, and oil contamination.*

20.1 Check the tire tread depth. If tread is less than 4/32 inch (3 mm) on any front tire, or less than 2/32 inch (1.5 mm) on any rear tire, replace the tire.

20.2 Inspect each tire for bulges, cracks, cuts, and penetrations.

20.3 Inspect each tire for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if allowed to contact the tires, will soften the rubber and destroy the tire.

21. *Check the wheel nuts or rim nuts for indications of looseness. Examine each rim and wheel component.*

21.1 Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes, metal buildup around stud holes, or out-of-round or worn stud holes may be caused by loose wheel nuts. See **Fig. 11.7** and **Fig. 11.8**.

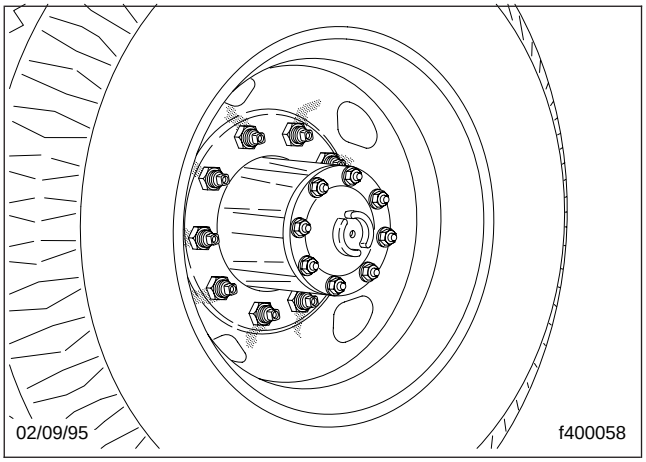


Fig. 11.7, Dirt and Rust Streaks from the Stud Holes

21.2 Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks, or other damage.

See **Group 33** or **Group 35** of the *Century Class Trucks Workshop Manual* for service procedures on the studs and hubs, and see **Group 40** in the same manual for wheel and tire servicing, or take the vehicle to an authorized Freightliner dealer.

⚠ WARNING

Have any worn or damaged wheel components replaced by a qualified person using the wheel manufacturer's instructions and the wheel industry's standard safety precautions and equipment. Otherwise a vehicle or workshop accident could occur, possibly resulting in serious personal injury or death.

21.3 Have broken, cracked, badly worn, bent, rusty, or sprung rings and rims replaced. Be sure that the rim base, lockring, and side ring are matched according to size and type.

21.4 Make sure all wheel nuts are tightened 450 to 500 lbf·ft (610 to 678 N·m) for Accuride wheels with unlubricated threads.

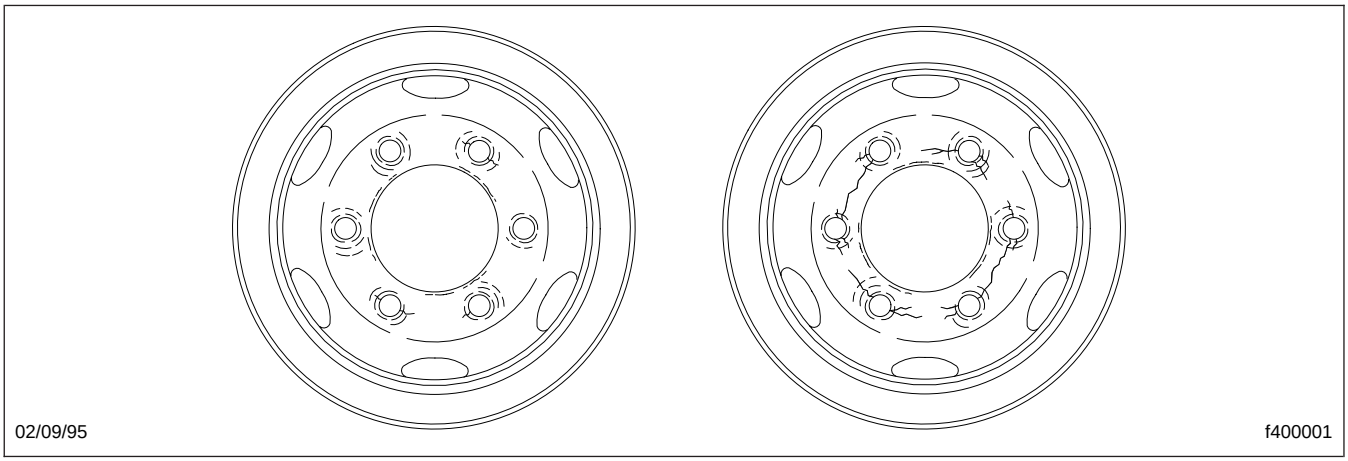


Fig. 11.8, Worn Stud Holes

Use the tightening pattern in **Fig. 11.9** for 10-hole wheels, and the tightening pattern in **Fig. 11.10** for 8-hole wheels. See **Group 40** of the *Century Class Trucks Workshop Manual* for more information.

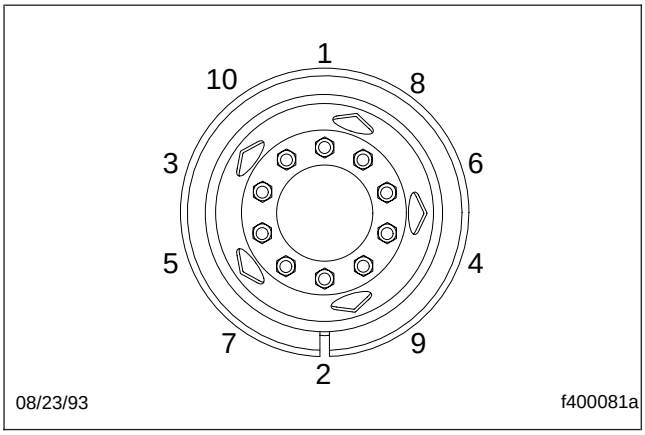


Fig. 11.9, Tightening Pattern, 10-Hole Wheels

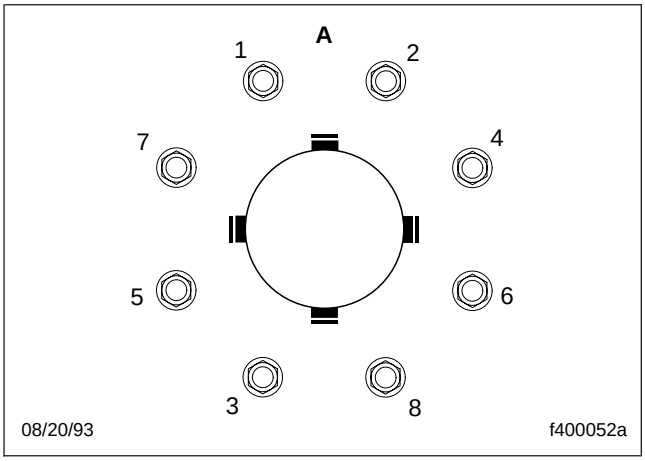


Fig. 11.10, Tightening Pattern, 8-Hole Wheels

CAUTION

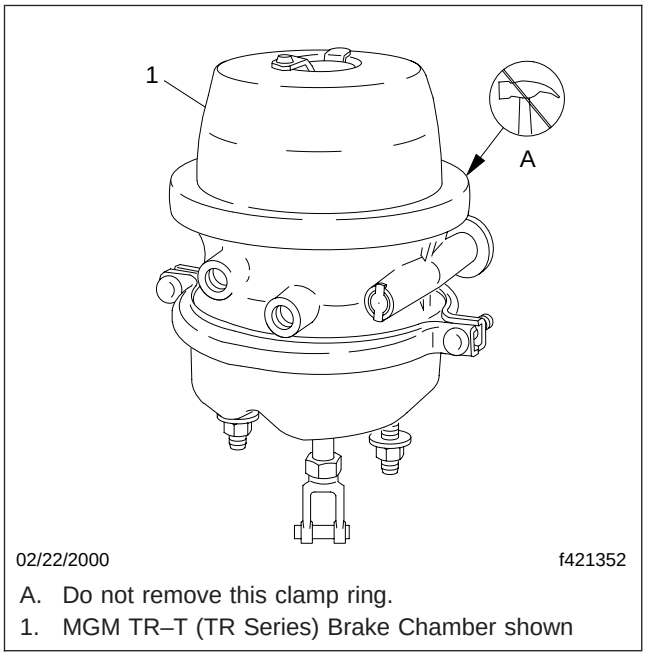
Insufficient wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values and follow the proper tightening sequence.

DANGER

Do not loosen or remove the parking brake clamp ring for any purpose. The parking/emergency brake section of the brake chamber is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in Group 42 of the *Century Class Trucks Workshop Manual*.

22. *Inspect the air brake chamber and the air brake chamber pushrods. See* **Fig. 11.11** .



A. Do not remove this clamp ring.
1. MGM TR–T (TR Series) Brake Chamber shown

Fig. 11.11, Parking Brake Chamber Clamp

WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control resulting in property damage or personal injury.

22.1 Check that the air brake chamber is mounted securely on its mounting bracket, and that there are no loose or missing bolts.

22.2 Look for worn clevis pins on brake chamber pushrods and missing or damaged cotter pins on brake chamber pushrod clevis pins. Replace worn clevis pins and install new cotter pins if necessary.

22.3 See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the non-pressure chamber and cause a dragging brake. See **Group 42** of the *Century Class Trucks Workshop Manual*.

⚠ CAUTION

If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside of the chamber, dirt and debris can cause the internal parts of the chamber to deteriorate faster.

22.4 Inspect the exterior surfaces of the chamber for damage. Make sure that breather holes in the non-pressure section(s) are open and free of debris. See **Group 42** of the *Century Class Trucks Workshop Manual* to replace any damaged parts.

22.5 On all parking brake installations, make sure the end cover cap or dust plug is securely snapped into place.

NOTE: On most MGM parking brake chambers equipped with an integral release bolt, an end cover cap is installed over the release bolt.

22.6 Check for rusted connections, missing snap rings, and damaged camshaft grease seals. Have damaged or missing parts repaired or replaced.

23. *Inspect the air brake lines.*

23.1 Check the clearance between the hoses and the exhaust manifold or other hot spots. Excessive heat will cause material in the hoses to deteriorate rapidly or become brittle. Provide at least 6 inches (150 mm) of clearance. More clearance is recommended if the hose is located above the heat source.

23.2 Check for kinks, dents, or swelling of the hoses. If damaged, have the hose replaced with the same size and type.

NOTE: Do not route the hose on top of anything likely to be stepped on.

23.3 Check for damage to hoses located near moving parts, such as drivelines, kingpins, suspensions, and axles. If moving parts are catching or pinching the lines, correct as needed.

23.4 Check for hose damage caused by abrasion. If abraded, have the hose replaced. Check for the cause of abrasion, such as loose or damaged hose clamps. Have the clamps repaired or replaced as needed.

23.5 Observe the hose cover condition, especially hoses exposed to water splash and ice. If dried out or ragged (the wire or liner is showing through the cover), have the hose(s) replaced.

23.6 Inspect the air tubing, especially tubing made of nylon. In cold weather, nylon tubing is sensitive to damage, such as nicks or cuts. Have nicked or cut tubing replaced, even if it is not leaking.

23.7 Check for kinked or twisted hoses. A seven-percent twist in the hose can reduce its life by up to 90 percent. A twisted hose under pressure tends to untwist, which may loosen the fitting. Reconnect hoses that are twisted.

NOTE: The front brake lines flex continuously in vehicle operation, so they require special examination. Give particular attention to the areas near where they connect to the front air brake chambers. This inspection requires two people, one in the driver seat and another to inspect the brake line connections at the wheels.

23.8 Both wheel air lines must be inspected with the emergency brake set, engine idling, air pressure at 80 to 90 psi (550 to 620 kPa), and the brake pedal held down.

23.9 Turn the wheels to full lock in one direction and inspect both air lines where they connect to the air chambers, then turn the wheels to full lock in the other direction and inspect both lines. If a hose is leaking, have it replaced.

IMPORTANT: ABS-equipped vehicles operating in regions where especially corrosive ice removal chemicals are used may experience higher than normal rotor corrosion. Tone rings should be routinely inspected for corrosion. Severe corrosion of the integral ABS tone ring may cause the ABS warning lamp in the dash to illuminate due to false wheel speed readings. If the ABS warning lamp illuminates at any time other than at vehicle start-up, have the problem repaired immediately.

24. *Inspect the slack adjusters.*

24.1 *Meritor Slack Adjusters:* Check the boot for cuts, tears, or other damage. Have it replaced if necessary.

24.2 *Gunite Slack Adjusters:* Inspect the slack adjuster for any signs of damage. If damaged, have the slack adjuster replaced.

Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, have it replaced. See **Fig. 11.12**.

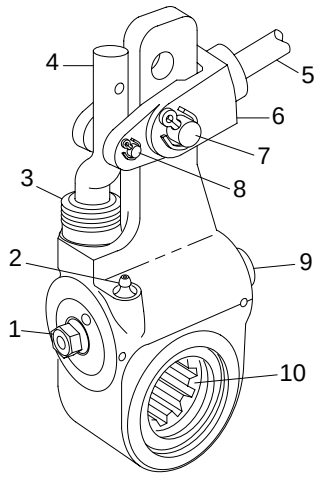
24.3 *Haldex Slack Adjusters:* Inspect each slack adjuster and anchor strap for damage. See **Fig. 11.13**. Have any damaged components replaced.

Check that the control-arm nut is fully released. If the control arm is in the wrong position, the brakes will drag.

25. *Check the air brake system for proper operation.*

25.1 Check the air governor cut-in and cut-out pressures as follows.

Run the engine at fast idle. The air governor should cut out the air compressor at approximately 120 psi (827 kPa). With the engine idling, apply the brake pedal several times. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not cut in and out as described above, it must be adjusted to these specifications. If the air governor cannot be adjusted or repaired, replace it before operating the vehicle.



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1. 7/16-inch Adjusting Nut
2. Grease Fitting
3. Boot
4. Link
5. Brake Chamber Piston Rod
6. Clevis
7. 1/2-inch Clevis Pin
8. 1/4-inch Clevis Pin
9. Grease Relief Opening
10. Slack Adjuster Spline

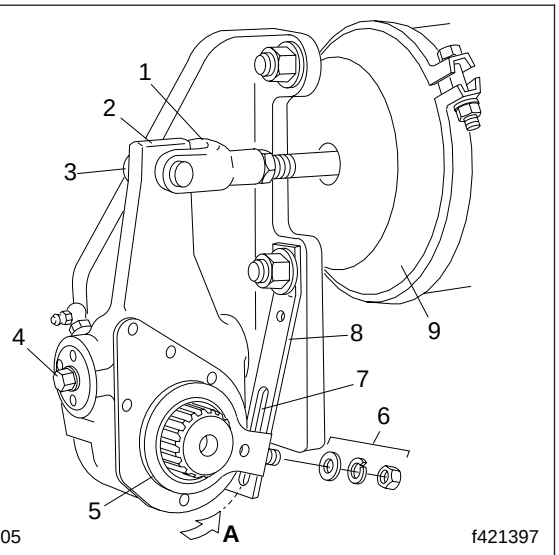
Fig. 11.12, Gunite Automatic Slack Adjuster

25.2 Check the air pressure buildup time as follows.

With the air system fully charged to 120 psi (827 kPa), make one full brake application and note the air pressure reading on the gauge. Continue to reduce the air pressure by moderate brake applications to a maximum of 90 psi (620 kPa), then run the engine at governed rpm. If the time required to raise the air pressure to 120 psi (827 kPa) (from the pressure noted after one brake application) is more than 30 seconds, eliminate any leaks or replace the air compressor before operating the vehicle.

25.3 Check the air pressure reserve as follows.

With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure



A. Rotate the control arm toward the brake chamber until you can feel it contacting the internal stop.

1. Clevis
2. Slack Adjuster
3. Clevis Pin
4. Manual Adjusting Nut
5. Control Arm
6. Control-Arm Washers and Nut
7. Anchor Strap Slot
8. Anchor Strap
9. Brake Chamber

Fig. 11.13, Haldex Automatic Slack Adjuster

drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

25.4 Check the air leakage in the system as follows.

With the parking brake (spring brake) applied, the transmission out of gear, and the tires chocked, charge the air system until cut-out pressure of 120 psi (827 kPa) is reached.

With the service brakes released, shut down the engine, wait one minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

Charge the air system until cut-out pressure of 120 psi (827 kPa) is reached. With the parking brakes released and the service brake applied, shut down the engine, wait one minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

If leakage exceeds the limits shown in **Table 11.4**, repair all areas of leakage before driving the vehicle.

Maximum Allowable Service Brake Air Leakage		
Description	**Air Leakage in psi (kPa) Per Minute**	
	Released	**Applied**
Truck or Tractor Only	2 (14)	3 (21)
Truck or Tractor w/Single Trailer	3 (21)	4 (28)
Truck or Tractor w/Two Trailers	5 (35)	6 (42)

Table 11.4, Maximum Allowable Service Brake Air Leakage

26. *Test the service brakes.*

When starting to move the vehicle and before picking up speed, test the brakes with the foot pedal and parking brake control valve (yellow knob) to be sure they will bring the vehicle to a safe stop.

Weekly Post-Trip Inspection and Maintenance Procedures

⚠ WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. *Inspect the batteries and battery cables. Check the battery cables for chafing, and proper routing. Replace the battery cable if damaged. Check that the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.*

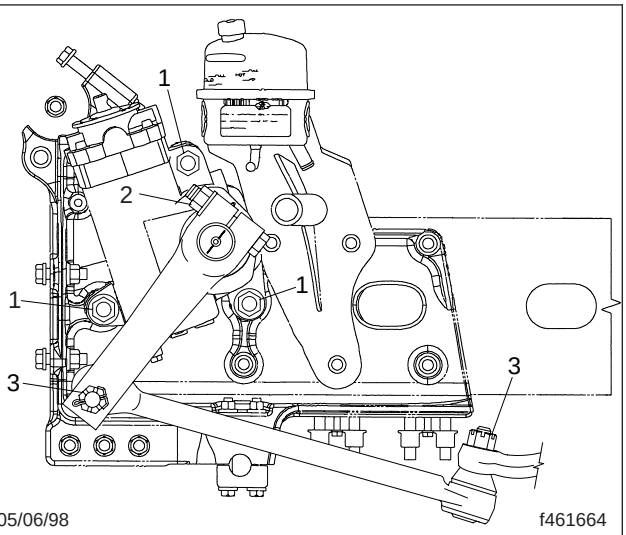
2. *Check the level of the wheel bearing lubricant in the hub cap at each end of the front axle.*

   If needed, fill the hubs to the level indicated on the hub cap. See **Group 35** of the *Century Class Trucks Maintenance Manual*, for recommended lubricants.

IMPORTANT: Before removing the fill plug, always clean the hub cap and plug.

3. *Examine the steering components.*

See **Fig. 11.14**. If repairs are needed, see **Group 46** of the *Century Class Trucks Workshop Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.



1. Steering Gear Mounting Bolt
2. Pitman Arm Pinch Bolt Nut
3. Drag Link Nut

Fig. 11.14, Steering Gear Fasteners

3.1 Check the mounting bolts and pitman arm nut for tightness.

3.2 Check the drag link nuts for missing cotter pins.

3.3 Inspect the steering drive shaft and steering linkage for excessive looseness, or other damage.

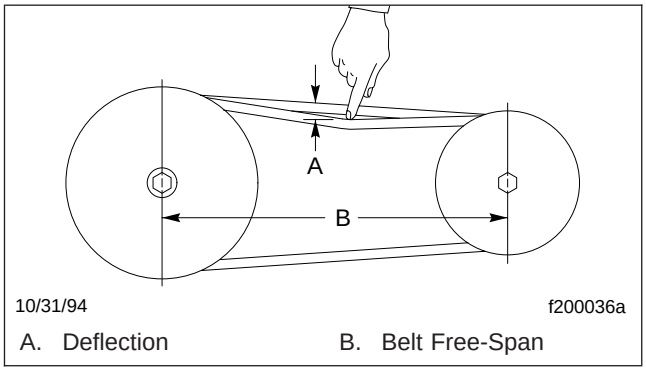
3.4 Tighten loose nuts and have damaged parts replaced as needed.

4. *Check the condition of the serpentine drive belt.*

Look for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, have the belt replaced, following the instructions in **Group 01** of the *Century Class Trucks Workshop Manual.*

5. *Check the drive belt for proper tension.*

Use your index finger to apply force at the center of the belt free-span. See **Fig. 11.15**. There is no adjustment for belt tension on engines with automatic belt tensioners. If there is not proper tension, have the belt tensioner replaced. See **Group 01** of the *Century Class Trucks Workshop Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.



A. Deflection B. Belt Free-Span

Fig. 11.15, Checking Belt Tension

6. *Inspect the seat belts and tether belts.*

WARNING

Inspect and maintain seat belts as instructed below. Worn or damaged seat belts could fail during a sudden stop or crash, possibly resulting in serious injury or death.

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

NOTE: When any part of a seat belt needs replacement, the entire seat belt must be replaced, both retractor and buckle side.

6.1 Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.

6.2 Check the web for extreme dirt or dust and for severe fading from exposure to sunlight.

6.3 Check the buckle and latch for operation and for wear or damage.

6.4 Check the Komfort Latch for function and cracks or other damage.

6.5 Check the upper seat belt mount on the door pillar for damage.

6.6 Check the web retractor for function and damage.

6.7 Check the mounting bolts for tightness and tighten any that are loose.

Monthly Post-Trip Inspection and Maintenance Procedures

⚠ WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. *Clean the batteries.*

   1.1 Remove any corrosion from the hold-down and the top of the battery.

⚠ CAUTION

Take care to keep the vent plugs tight so that the neutralizing solution does not enter any of the battery cells and damage the battery.

   1.2 Use a soda solution to neutralize the acid present, then rinse off the soda solution with clean water.

   1.3 If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of petroleum jelly to the posts and terminals to help retard corrosion.

2. *Inspect the radiator and heater hoses, including the clamps and support brackets.*

   2.1 Make sure the radiator inlet and outlet hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.

   2.2 Make sure the heater hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.

   2.3 Tighten hose clamps as necessary, but do not overtighten, as hose life can be adversely affected.

   2.4 Be sure the hose support brackets are securely fastened. Make sure the hoses are not located near sources of wear, abrasion, or high heat.

IMPORTANT: Replace all hoses, including heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. Silicone hoses having an extended service life can be substituted for the reinforced neoprene type. See the Freightliner *Service Parts Catalog* or contact your Freightliner Dealer.

3. *Check the steering wheel for excessive play.*

   3.1 With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels.

   3.2 Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction until motion is again detected at the wheels.

   3.3 Measure the lash (free play) at the rim of the steering wheel. Excessive lash exists if steering wheel movement exceeds 2-1/4 inches (57 mm) with an 18-inch (450-mm) steering wheel.

   If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear before operating the vehicle.

4. *Check the brake lining wear on all vehicles, including those with automatic slack adjusters. Proper brake operation is dependent on periodic maintenance and inspection of the brake linings.*

   4.1 Check that brake linings are free of oil and grease.

   4.2 Inspect the thickness of the brake linings. If the axle assembly is equipped with a dust shield or backing plate, remove the inspection plugs. If *any* brake linings are

worn to less than approximately 1/4 inch (6.4 mm) at the thinnest point, have the linings replaced on *all* brake assemblies on that axle. See **Group 42** of the *Century Class Trucks Workshop Manual* for lining replacement instructions and camshaft end-play inspection.

4.3 Check the brake drums for wear and cracks.

4.4 Check that the inspection plugs in the dust shields or backing plates, if so equipped, are installed.

12

Cab Appearance

Cab Washing and Polishing 12.1
Care of Fiberglass Parts 12.1
Care of Chrome Parts 12.1
Dashboard Care 12.1
Vinyl Upholstery Cleaning 12.1
Velour Upholstery Cleaning 12.2

Cab Appearance

Cab Washing and Polishing

To protect the finish of your new vehicle, follow these guidelines carefully:

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle's finish, follow these guidelines:

- Avoid washing your vehicle in the hot sun.
- Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. Before waxing, if the finish has become dull, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Freightliner recommends that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface with water.
- To prevent rust, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

Care of Fiberglass Parts

Wash unpainted fiberglass air fairings and shields monthly with a mild detergent, such as dishwashing liquid. Avoid strong alkaline cleansers.

Apply a wax specifically designed for fiberglass.

Care of Chrome Parts

To prevent rust, keep chrome parts clean and protected at all times. This is especially important during winter driving and in coastal areas where there is exposure to salt air.

When cleaning chrome parts, use clean water and a soft cloth or sponge. A mild detergent may also be used.

Sponge gently, then rinse. If necessary, use a nonabrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

Dashboard Care

Periodically wipe the dashboard with a water-dampened cloth. A mild detergent can be used, but avoid using strong detergents.

⚠ CAUTION

Do not use Armor-All Protectant®, STP Son-of-a-Gun®, or other equivalent treatments. These cleaners contain vinyl plasticizers that can cause stress crazing in the interior plastic panels, which can result in cracking of the panels.

Vinyl Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

Ordinary Dirt

Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times, as necessary.

If dirt is deeply imbedded, use a soft bristle brush after applying the soap.

If dirt is extremely difficult to remove, wall-washing preparations normally found around the home can be used. Powdered cleaners, such as those used for sinks and tiles, are abrasive and must be used with caution as they can scratch the vinyl or give it a permanent dull appearance.

Chewing Gum

Harden the gum with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Any remaining traces of gum can be removed with an all-purpose light oil (peanut butter will also work) and wiped off.

Tars, Asphalts, and Creosote

Each of these items stains vinyl after prolonged contact. They should be wiped off immediately and the area carefully cleaned, using a cloth dampened with naphtha.

Paint, Shoe Heel Marks

Paint should be removed immediately. Do not use paint remover or liquid-type brush cleaner on vinyl. An unprinted cloth, dampened with naphtha or turpentine may be used. Use care to prevent contact with parts of the upholstery that are not vinyl.

Sulfide Stains

Sulfide compounds, such as those found in eggs and some canned goods, can stain after prolonged contact with vinyl. These stains can be removed by placing a clean, unprinted piece of cloth over the spotted area and pouring a liberal amount of 6 percent hydrogen peroxide onto the cloth. Allow the saturated cloth to remain on the spot for 30 to 60 minutes. For stubborn spots, allow the hydrogen-peroxide saturated cloth to remain on the area overnight. Use caution to prevent the solution from seeping into the seams, or it will weaken the cotton thread.

Nail Polish and Nail Polish Remover

Prolonged contact with these substances causes permanent damage to vinyl. Careful blotting immediately after contact minimizes damage. Do not spread the liquid during removal.

Shoe Polish

Most shoe polishes contain dyes which penetrate vinyl and stain it permanently. Shoe polish should be wiped off as quickly as possible using naphtha or lighter fluid. If staining occurs, try the procedure used for sulfide stains.

Ball Point Ink

Ball point ink can sometimes be removed if rubbed immediately with a damp cloth, using water or rubbing alcohol. If this does not work, try the procedure used for sulfide stains.

Miscellaneous

If stains do not respond to any of the treatments described above, it is sometimes helpful to expose the vinyl to direct sunlight for up to 30 hours. Mustard, ball point ink, certain shoe polishes, and dyes often bleach out in direct sunlight, leaving the vinyl undamaged.

Velour Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Spot clean with a mild solvent or an upholstery shampoo, or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow the instructions carefully, and clean only in a well-ventilated area. Avoid any product that contains carbon tetrachloride or other toxic materials. With either method, pretest a small area before proceeding. Use a professional upholstery cleaning service when extensive cleaning is needed.

Grease and Oil-Based Stains

Dampen a small absorbent cloth with dry-cleaning solvent or spot remover. Apply the cloth carefully to the spot from the outer edge to the center. Pat and blot the spot with a clean, dry cloth. Repeat several times, as necessary, turning the cloths so that the stain does not redeposit on the fabric.

Sugar and Water-Based Stains

Apply water-based detergent or cleaner, working in circular motions. Pat and blot as dry as possible. Repeat, if necessary, before drying thoroughly.

Chewing Gum or Wax

Harden the gum or wax with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Excess wax can be absorbed by placing a thick white blotter over the wax and heating with a warm (not hot) iron. Remove the remainder by using the procedure for grease and oil-based stains.

Mildew

Brush the dry fabric with a soft brush. Sponge with detergent, and blot. If the fabric is colorfast, dilute a teaspoon of bleach in one quart (one liter) of cool water. Apply with a swab, directly on the mildew stain. Dab repeatedly with clear, cool water, and blot dry.

13

In an Emergency

Hazard Warning Lights 13.1
Fire Extinguisher 13.1
Emergency Kit, Optional 13.1
Towing 13.1
Emergency Starting with Jumper Cables 13.3
Fire in the Cab 13.4

Hazard Warning Lights

The hazard warning light switch tab is located on the turn signal control lever. See **Fig. 13.1**. To operate the hazard lights, pull the tab out. All of the turn signal lights and both of the indicator lights on the control panel will flash.

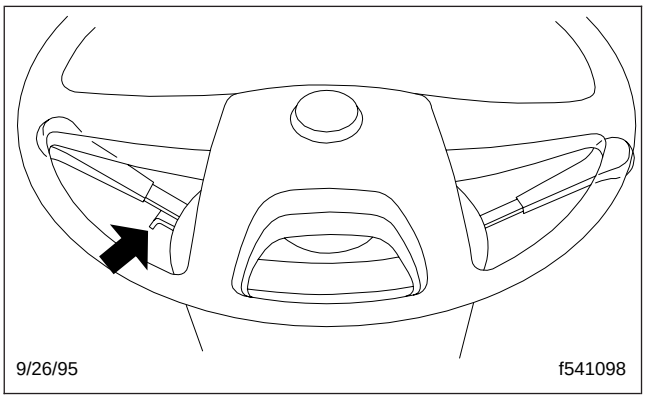


Fig. 13.1, Hazard Warning Light Switch Tab

To cancel the hazard warning lights, push the turn signal control lever either up or down, then return the lever to its neutral position.

Fire Extinguisher

A fire extinguisher is located in the cab by the driver's door.

Emergency Kit, Optional

An optional emergency kit package is located between the seats, at the front of the center console, if the vehicle does not have a sleeper compartment. If there is a sleeper compartment, the emergency kit is located elsewhere, depending on vehicle configuration. The package includes one or more of each of the following: first aid kit, a reflective vest, and a triangular reflector and flare kit.

If there is an emergency while driving, cautiously pull off the road, paying attention to other traffic. Turn on the hazard warning lights. Place the flares and reflector along the side of the road, to alert other drivers that an emergency situation exists.

⚠ WARNING

Use extreme care when placing flares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or fire could occur causing serious personal injury.

Towing

When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.

⚠ WARNING

Do not tow an unbraked vehicle if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWR) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

Front Towing Hookup

1. Disconnect the battery ground cables.

⚠ CAUTION

Failure to remove the axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

2. Remove both drive axle shafts. On dual drive axles, if the vehicle is to be lifted and towed, remove only the rearmost drive axle shafts.

   On vehicles equipped with an air fairing, remove both the forward and rearmost drive axle shafts if there is insufficient towing clearance.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out, and will keep contaminants from getting into and damaging the wheel bearings and axle lubricant.

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

4. On dual drive axles, if the vehicle is to be lifted and towed, chain the forward rear-axle assembly to the vehicle frame; use protection to keep the chains from damaging the frame.
5. Remove the bumper extension and chrome bumper, if so equipped. Remove the bumper fairing, if so equipped.
6. On vehicles equipped with an air fairing, adjust the trim tab to the lowest position.

CAUTION

Do not pass a sling (for example, a rope or chain) from one tow hook to another to fasten for towing (see Fig. 13.2). Known as reeving, this practice is *not* permissible in most industrial applications of towing and hoisting. Reeving can overload the hooks and result in damage to the vehicle.

7. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
8. On vehicles equipped with an air fairing, measure the distance from the ground to the bumper, or from the ground to a frame bracket.
9. Lift the vehicle, and secure the safety chains. If extra towing clearance is needed, remove the front wheels.

WARNING

Failure to lower the vehicle could result in the air fairing striking an overhead obstruction, such as a bridge or overpass, and causing vehicle damage or personal injury.

10. On vehicles equipped with an air fairing, repeat the measurement taken in step 8. The difference between the two measurements must not exceed 14 inches (36 cm). If necessary, lower the vehicle.
11. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.

WARNING

Failure to chock the tires or connect the tow truck's air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

12. Chock the disabled vehicle's tires, and connect the towing vehicle's air brake system to the vehicle being towed. Then, release the spring parking brakes and remove the chocks.

Rear Towing Hookup

CAUTION

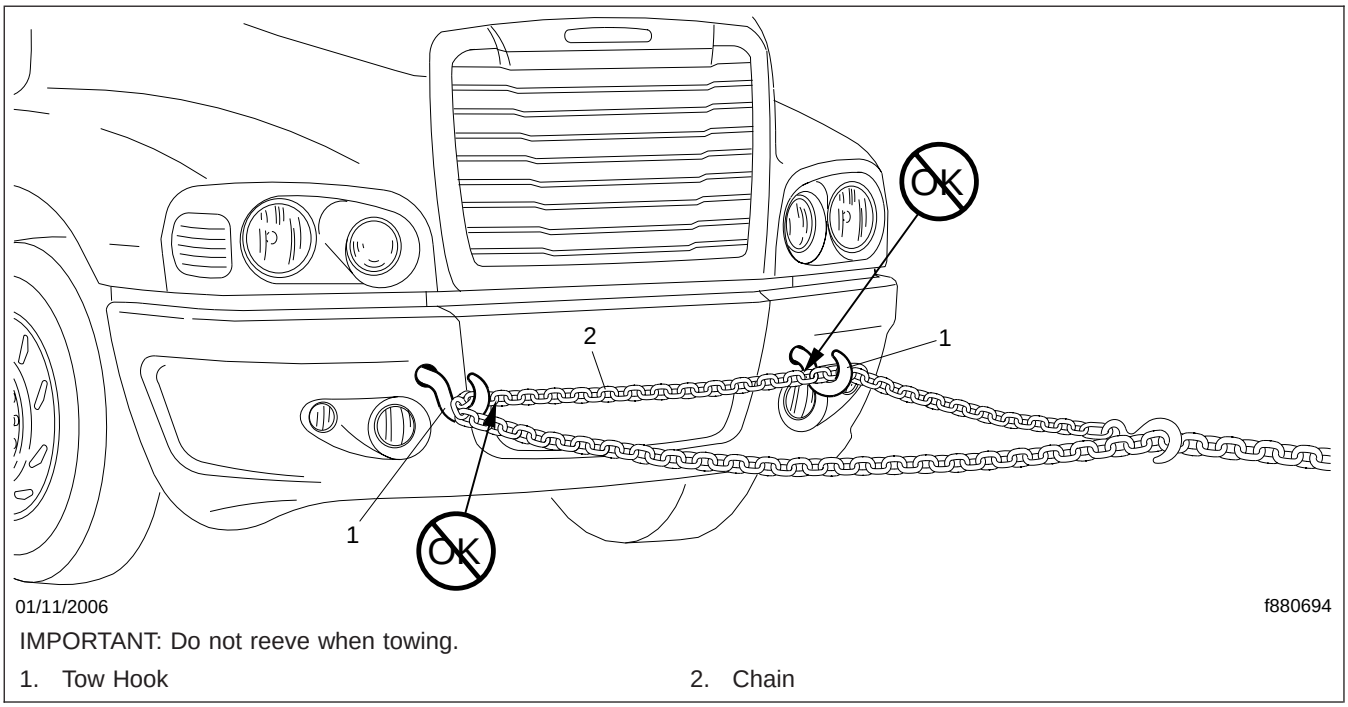
Using a rear towing hookup on a vehicle equipped with a roof fairing could cause damage to the cab structure.

1. Place the front tires straight forward, and secure the steering wheel in this position.
2. Disconnect the battery ground cables.

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

3. On dual drive axles, using protection to keep the chains from damaging the vehicle frame, chain the forward-rear drive axle to the frame.
4. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
5. Lift the vehicle, and secure the safety chains. If extra clearance is needed, remove the bumper extension, if equipped.
6. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.



IMPORTANT: Do not reeve when towing.

1. Tow Hook
2. Chain

Fig. 13.2, Reeving

Emergency Starting with Jumper Cables

When using jumper cables, follow the instructions below.

⚠ WARNING

Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.

⚠ CAUTION

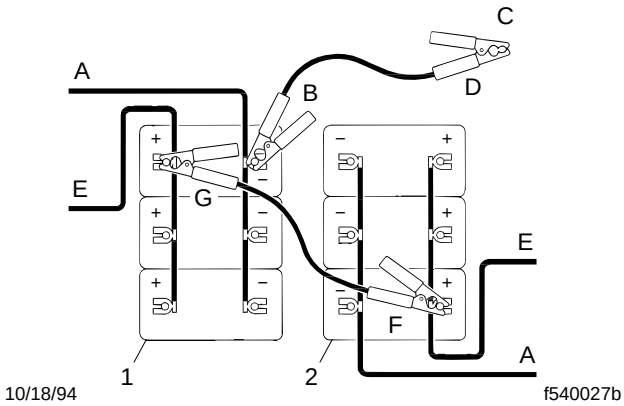
Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Also, do not attempt to charge isolated, deep-cycle batteries with jumper cables. Follow the battery manufacturer's instructions when charging deep-cycle batteries.

NOTE: On vehicles equipped with an optional jump-start post, attach the positive cable clamp to that post instead of to the battery.

1. Apply the parking brakes and turn off the lights and all other electrical loads.
2. Connect an end of one jumper cable to the positive terminal of the booster battery (or jump-start post, if equipped), and connect the other end of the cable to the positive terminal of the discharged battery (or jump-start post, if equipped). See **Fig. 13.3**.

⚠ WARNING

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.



A. To Ground
B. Connect 3rd
C. To Frame (ground)
D. Connect Last
E. To Starter
F. Connect 2nd
G. Connect 1st
1. Booster Battery
2. Discharged Battery

Fig. 13.3, Jumper Connections

3. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to a ground at least 12 inches (300 mm) away from the batteries of the vehicle needing the start. The vehicle frame is usually a good ground. Do *not* connect the cable to or near the discharged batteries.
4. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.
5. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.
6. When the engine starts, let it idle a few minutes.

⚠ WARNING

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

7. Disconnect the grounded cable from the frame or other nonbattery location; then disconnect the other end of the cable.
8. Disconnect the remaining cable from the newly charged battery (or jump-start post, if equipped) first; then disconnect the other end.

Fire in the Cab

The incidence of fire in heavy- and medium-duty trucks is rare, according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab, but despite this, most materials will burn. The cab of this vehicle contains urethane foam, which is of concern in this respect.

⚠ WARNING

Urethane foam is flammable! Do not allow any flames, sparks, or other heat sources such as cigarettes or light bulbs to contact urethane foam. Urethane foam in contact with such heat sources could cause a serious, rapid fire, which could result in death, severe burns, or gas poisoning, as well as damage to the vehicle.

In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

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